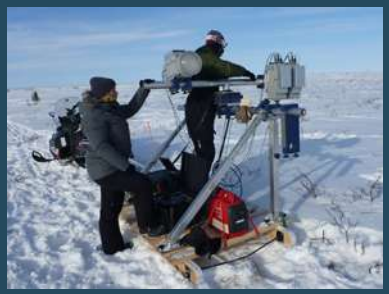
INTERACT

INTERACT

International Network for Terrestrial Research and Monitoring in the Arctic

Fieldwork Planning Handbook



Eds. Morten Rasch et al.

INTERACT

Fieldwork Planning Handbook

AARHUS
UNIVERSITY
DCE – DANISH CENTRE FOR ENVIRONMENT AND ENERGY

INTER⇄ACT

INTERACT Fieldwork Planning Handbook

Editors:
Morten Rasch – University of Copenhagen, Denmark
Elmer Topp-Jørgensen – Department of Bioscience, Aarhus University, Denmark
Gerlis Fugmann – Alfred Wegener Institute, Helmholtz-Centre for Polar and Marine Research, Potsdam, Germany/Association of Polar Early Career Scientists (APECS)
Fred Skancke Hansen – University Centre on Svalbard, Longyearbyen, Svalbard

Lead-authors:
Fiona Tummon – UiT The Arctic University of Norway, Tromsø, Norway/Association of Polar Early Career Scientists (APECS), now based at the Federal Office of Meteorology and Climatology MeteoSwiss, Payerne, Switzerland
Andrea Schneider – UiT The Arctic University of Norway, Tromsø, Norway/Association of Polar Early Career Scientists (APECS)

Co-authors:
Julie Bull – University of New Brunswick/University of Toronto, Canada
Gwenaëlle Gremion – Institut des Sciences de la Mer, Québec-Océan, Université du Québec à Rimouski, Canada
Gabriela Roldan – Gateway Antarctica, University of Canterbury, New Zealand
Morgan Seag – Scott Polar Research Institute, University of Cambridge, United Kingdom
Ruth Vingerhagen Hindshaw – Department of Earth Sciences, University of Cambridge, United Kingdom

Further input:
All the station managers in INTERACT

Published 2019, First edition

Graphic design: Juana Jacobsen & Kathe Møgelvang, AU Bioscience Graphics Group

Publisher: Aarhus University, DCE – Danish Centre for Enviroment and Energy

Citation: INTERACT Fieldwork Planning Handbook. Eds.: Rasch, M. *et al.*
DCE – Danish Centre for Environment and Energy, Aarhus University, Denmark. 148 p.

Printed in Denmark 2019
by Rosendahls-Schultz Grafisk

ISBN: 978-87-93129-13-9

The book is available in PDF from the INTERACT website **www.eu-interact.org.**

INTERACT is a network of more than 85 research stations located in the Arctic and northern Alpine and forested areas. The network builds capacity for identifying, understanding, predicting, and responding to environmental change. It brings together managers of research stations, facilitates coordinated research and monitoring, and put scientists in the field through a Transnational Access funding programme.

This infrastructure is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°730938.

INTERACT was funded by EU 7th Framework Programme during 2011-2015.

www.eu-interact.org

Svalbard (Jago Wallenschus)

Segregated ice in permafrost, Lena River Delta, Russia
(Michael Fritz).

CONTENTS

ABOUT THE AUTHORS

EDITORS

Morten Rasch – *University of Copenhagen, Denmark*

Morten is chief consultant at the University of Copenhagen, Denmark, and the station manager at Arctic Station in central West Greenland. Over the years, he has been leading several research stations in Greenland, has been involved in the establishment of Zackenberg Research Station and Villum Research Station, has been coordinating the long-term Greenland Ecosystem Monitoring (GEM) programme and is currently the chairman of the INTERACT Station Managers' Forum. Besides that Morten is a passionate photographer.

Elmer Topp-Jørgensen – *Department of Bioscience, Aarhus University, Denmark*

Elmer is special adviser at Aarhus University in Denmark and the coordinator for the INTERACT Station Managers' Forum. He also runs secretariats for the Greenland Ecosystem Monitoring (GEM) programme and the Forum of Arctic Research Operators (FARO) that facilitates information exchange between operators of arctic research infrastructures. Elmer's scientific fields of interest include biodiversity conservation, wildlife management, and community-based monitoring.

Gerlis Fugmann – *Alfred Wegener Institute, Helmholtz-Centre for Polar and Marine Research, Potsdam, Germany*

Gerlis is the Executive Director of APECS. She enjoys interacting with APECS members and partners worldwide, and is helping to create, shape, and manage many of APECS' projects, resources and events. Throughout her research career in the Canadian and Scandinavian North, Gerlis focused on topics related to economic development, tourism, as well as northern engagement and participation in innovation and the knowledge economy.

Fred Skancke Hansen – *University Centre on Svalbard, Longyearbyen, Svalbard*

Working as the director of the of Health, Safety and Environmental and Infrastructure department at the University Centre on Svalbard (UNIS) for more than 20 years, Fred has extensive experience in supporting scientific field operations in summer and winter. He is responsible for all infrastructure and coordination of logistics services connected to both marine and terresterial field operations, as well as safety training of UNIS students and staff.

LEAD-AUTHORS

Fiona Tummon – *UiT The Arctic University of Norway, Tromsø, Norway / Association of Polar Early Career Scientists (APECS), now based at the Federal Office of Meteorology and Climatology MeteoSwiss, Payerne, Switzerland*

Fiona grew up in South Africa, and after finishing a PhD in regional modelling, she relocated to Switzerland for a postdoc. She spent much of her time involved in science communication and project management. As a participant in the 2016/17 Antarctic Circum-navigation Expedition, Fiona fulfilled her dream of going to Antarctica. She was the APECS project officer in 2017 and 2018 and is passionate about the Alpine environment.

Andrea Schneider – *UiT The Arctic University of Norway, Tromsø, Norway / Association of Polar Early Career Scientists (APECS)*

As a paleo-ecologist, Andrea has studied biological indicators from frozen ground and seasonal arctic freshwater ecology in Siberia and on Svalbard. She reconstructed methane release from the seafloor offshore Svalbard during her PhD and helped master students to become micropaleontologists. She has extensive fieldwork experience in terrestrial and marine arctic environments in summer and winter. As APECS project officer from 2018, Andrea enters her fifth arctic dark season.

CO-AUTHORS

Julie Bull – *University of New Brunswick / University of Toronto, Canada*

Julie is an interdisciplinary researcher and educator with more than 15 years of experience in community-based research involving Indigenous Peoples from Labrador, Canada. She is dedicated to ensuring collaboration between Indigenous governance, research and policy making in the Arctic. Julie was active in the APECS Council 2017-2018.

Gwenaëlle Gremion – *Institut des Sciences de la Mer, Québec-Océan, Université du Québec à Rimouski, Canada*

Gwenaëlle is a PhD researcher studying how marine primary production responds to environmental changes such as reduced sea ice and changes in polynias using modeling approaches. She represents APECS France and is APECS Council member 2017-2019.

Gabriela Roldan – *Gateway Antarctica, University of Canterbury, New Zealand*

Gabriela is the APECS Vice-President in 2018-2019 and member of the APECS Executive Committee 2017-2019. Her PhD project looks at how the Antarctic gateway cities connect to build an Antarctic identity. Gabriela travels frequently to Antarctica when she is working as a tourist guide.

Morgan Seag – *Scott Polar Research Institute, University of Cambridge, United Kingdom*

Morgan is a PhD candidate studying the integration of women into national Antarctic programs. She has spent two season working as science outreach communication specialist at McMurdo Station, Antarctica. She is active in the APECS Council 2017-2019.

Ruth Vingerhagen Hindshaw – *Department of Earth Sciences, University of Cambridge, United Kingdom*

Ruth was the APECS President of the 2015-2016 term and was active in the APECS Executive Committee 2014-2016. Her research focuses on the water chemistry of rivers draining glaciated and permafrost-dominated landscapes.

Gerlis Fugmann
(Gerlis Fugmann)

PREFACE FROM THE ASSOCIATION OF POLAR EARLY CAREER SCIENTISTS

For many researchers, fieldwork is an important part of the research process to collect the data needed to answer their research questions. In the Arctic, with its beautiful, wild, but also unforgiving nature, being well prepared for a fieldwork campaign is essential to ensure not only the success of the data collection for the researchers, but also to ensure a high level of safety for all participants. However, what are the aspects that you need to think about when planning your fieldwork? Whom can you contact if you have questions during the planning process?

Early career researchers (ECRs) are those most likely to have never organised fieldwork before and many may never even have been in the Arctic before. Therefore, they naturally have many questions about what they need to take into consideration during the preparation phase of their fieldwork, including anything from how to get the necessary permits, how to prepare for different safety aspects in the field, what to pack, what to expect and how to go about things when actually at the field site.

The Association of Polar Early Career Scientists (APECS) and INTERACT therefore decided to collaborate on developing this INTERACT Fieldwork Planning Handbook*, which includes many handy tips and tricks for planning your fieldwork, various checklists, important contacts, and online resources where you can find even more information.*

This was a unique project as it was developed with the help of several early career researchers in cooperation with the INTERACT Station Managers' Forum to ensure that we cover the most important issues for fieldwork at INTERACT stations.

I want to specifically thank Fiona Tummon for her tireless work drafting the book, as well as collecting and integrating the resources, and feedback. Thank you also to the group of APECS members who helped with the drafting of the book (Julie Bull, Gwenaëlle Gremion, Gabriela Roldan, Morgan Seag, Ruth Vingerhagen Hindshaw). This book would not have been possible without the advice and support from the chairs of the INTERACT Station Managers' Forum, Morten Rasch and Elmer Topp-Jørgensen, as well as the many INTERACT station managers, who provided input at the various stages of this book. Last but not least, thank you to Andrea Schneider for coordinating the final publication phase of this book, the numerous photographers for providing free access to their pictures and to Juana Jacobsen and Kathe Møgelvang from Aarhus University, taking care of the layout and design and thereby giving the book its final touch.

We are aware that it is impossible to give advice and resources for all the situations you may encounter when preparing and carrying out your fieldwork. Nevertheless, we hope this book covers the most important aspects of fieldwork preparations and that it will be a useful resource for planning your next fieldwork in the Arctic or other cold regions of the world. Always remember that your personal safety comes first and before any research results you may want to collect.

Gerlis Fugmann
Executive Director, Association of Polar Early Career Scientists (APECS)

Northeast Greenland (Katrine Raundrup)

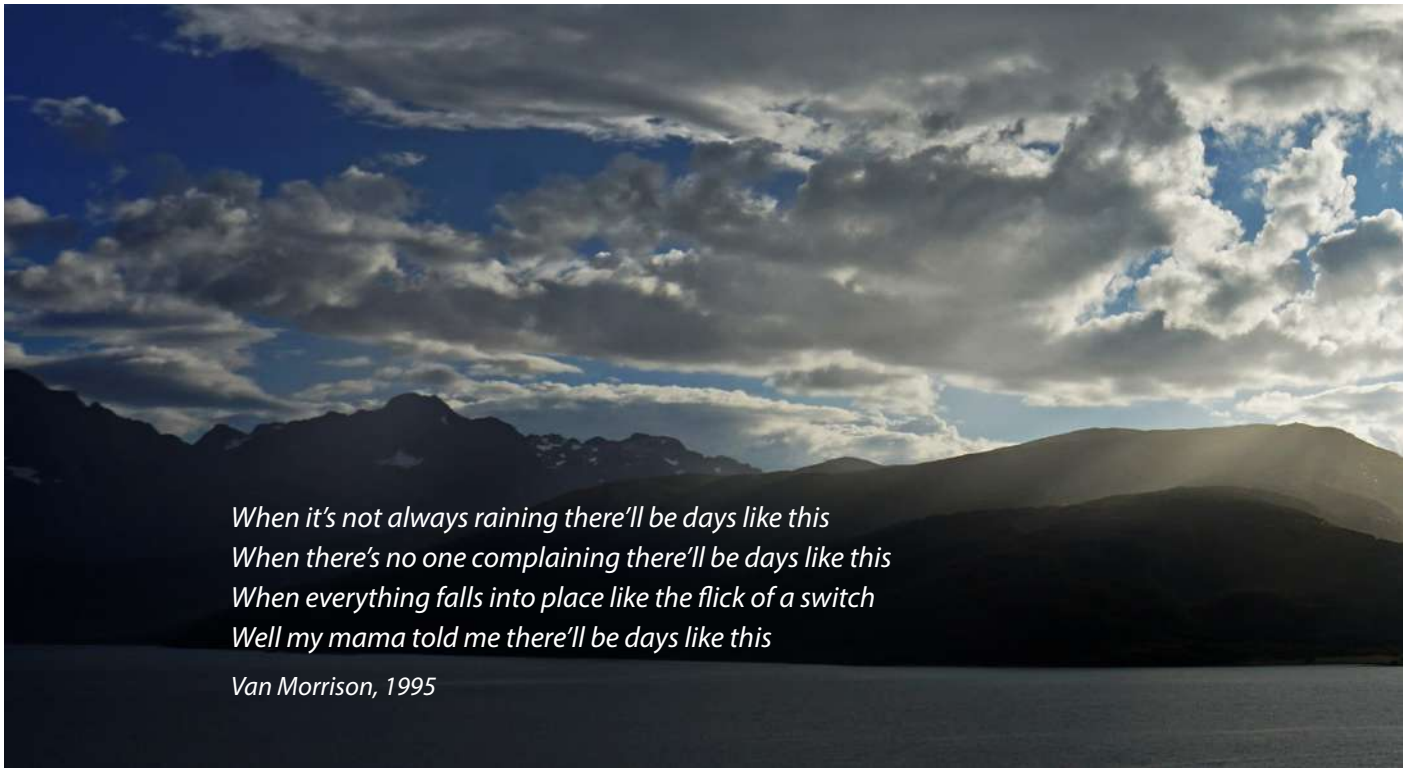
Morten Rasch and Elmer Topp-Jørgensen (Riku Paavola)

PREFACE FROM THE INTERACT STATION MANAGERS' FORUM

For most scientists, doing fieldwork in Arctic and northern Alpine areas is a precious part of their work, making it a lifetime experience. The Northern-Irish singer and song writer Van Morrisson once made a song called 'Days Like This' that can be interpreted as describing what fieldwork is all about on those days 'When everything falls into place like a flick of the switch'.

It takes a vast amount of effort to reach that far and to make those precious days as numerous as possible. Doing fieldwork at remote field sites requires not only detailed scientific planning but also thorough legal preparations, most often international coordination, and comprehensive logistics. Before leaving home, instruments need to be tested, provision and camp equipment to be bought, large amounts of cargo to be shipped, and safety precautions to be taken. Last but not least, having plan A, B, C, D, E, … is always a good idea when heading to the Arctic. All these preparations are key to reach a remote field site after travelling with a lot of luggage, and to overcome challenges such as stormy days in a small and wet tent with things that do not develop as it was anticipated.

The idea behind this handbook is to help scientists increasing the number of successful and enjoyable days in the field and return home with new data, samples, and results to share. The need for a book like this was recommended by the managers of the over 85 stations being part of the INTERACT Station Managers' Forum. They all maintain station facilities, support fieldwork activities, and have a strong interest in receiving properly prepared visitors and ensuring that their science plans are executed as safely and smoothly as possible. Making a textbook on fieldwork planning may help scientists to be better prepared, and simultaneously may reduce much of the station manager's work both in relation to advising scientists on arctic fieldwork planning and managing issues at the station due to insufficient



preparations. Station managers are there to support scientists, and they are most willing to help in every way possible. But, it also makes the life of a station manager much easier when the visiting scientists are well-prepared and know what is expected from them while working at INTERACT stations that are located in remote, often cold and harsh natural environments.

Early in the process of developing this book, we decided that it should be written by young scientists and not by station managers. We wanted it to be written in the language of young scientists and we thought that having the experiences from your own first fieldwork clear in mind while writing would be an advantage. We therefore decided to invite Association of Polar Early Career Scientists (APECS) to help us with the writing in close cooperation with individual station managers and the INTERACT Station Managers' Forum. This has been a great choice and an excellent cooperation. We are extremely impressed with the enthusiasm and seriousness that has been put into the work, especially by the two main authors, Fiona Tummon and Andrea Schneider, but also by their co-authors Julie Bull, Gwenaëlle Gremion, Gabriela Roldan, Morgan Seag and Ruth Vingerhagen Hindshaw, and by the huge network of early career scientists who have provided their specific knowledge for the book. We are very grateful for your efforts and for the valuable support this book will provide for the scientific community including both early career and more experienced scientists working in the Arctic as well as alpine and northern boreal locations.

Thanks for the help.

Elmer Topp-Jørgensen and Morten Rasch
INTERACT Station Managers' Forum

Skulsfjord, Kvaløya, Tromsø, Norway (Nina Friis)

ABOUT INTERACT

INTERACT is a circum-arctic network with over 85 terrestrial field stations in the Arctic and adjacent boreal and alpine areas. INTERACT specifically seeks to build capacity for research and monitoring in the Arctic and beyond and offers access to numerous research stations through the Transnational Access programme.

One of the main objectives of the project, funded by the European Union through the Horizon 2020 Programme, is to build capacity for identifying, understanding, predicting and responding to diverse environmental changes throughout the Arctic. This is fundamental, since the Arctic is so vast and sparsely populated that the environmental observing capacity is limited compared to most other regions.

INTERACT offers a multidisciplinary research platform, and together the INTERACT stations host thousands of scientists from around the world who, for example, work on projects within the fields of glaciology, permafrost, climate, ecology, biodiversity and biogeochemical cycling. The INTERACT stations also host and facilitate many international single-discipline networks and support educational activities by hosting courses and training schools.

It is a priority for INTERACT to support the education of future polar scientists and INTERACT therefore cooperates closely with the Association of Polar Early Career Scientists (APECS) to facilitate this. One of the results of this cooperation is this handbook developed to improve fieldwork preparations of young and experienced scientists alike.

The book is one in a series of publications by INTERACT to improve the services offered by research stations to the scientific community and to facilitate efficient and safe fieldwork by the scientists themselves.

INTERACT Publications (available on www.eu-interact.org):

INTERACT Fieldwork Planning Handbook:
Support for scientists to better prepare and conduct fieldwork in cold and remote areas.

INTERACT Management planning for Arctic and northern alpine research stations:
Help research station managers develop relevant management procedures and services to the scientific communities.

INTERACT Station Catalogue:
Provide scientists with an overview of potential research stations for their specific research aims.

INTERACT Research and Monitoring:
Provide scientists and station managers with an overview of existing data to build on or gaps to fill. Also provides recommendations for a minimum monitoring system for research stations.

INTERACT Stories of Arctic Science:
Provide examples of some of the fascinating research projects funded through the INTERACT Transnational Access funding mechanism.

INTERACT Pocket Guides:
INTERACT Street View Manual, INTERACT Pocket Guide – Drones, and
INTERACT Practical Field Guide.

ABOUT APECS

The Association of Polar Early Career Scientists (APECS) is an international organisation for undergraduate and graduate students, postdoctoral researchers, early faculty members, early career professionals, educators and others with interests in the Polar and Alpine regions as well as the wider cryosphere. APECS strives to create opportunities for early career researchers to enhance innovative and inter-disciplinary collaborations across the globe, helping to retain and promote the next generation of cryosphere enthusiasts. APECS serves as an institutional partner supporting the involvement of early career researchers in a wide range of activities and organisations, including international projects such as INTERACT.

Working together with the INTERACT Station Managers' Forum, a group of APECS members has helped put together this Fieldwork Planning Handbook with the aim of providing a resource for anyone planning fieldwork at the research stations of the INTERACT network and elsewhere in the Polar and Alpine regions of the world.

APECS' website: www.apecs.is

Kilpisjärvi Biological Station, Finland (Antero Järvinen)

INTERACT Stations

Numbers assigned to the stations are continuously updated as the network expands and may therefore not follow the numbering in other INTERACT publications.

INTERACT STATIONS

SVALBARD
1 Netherlands' Arctic Station
2 UK Arctic Research Station
3 CNR Arctic Station "Dirigibile Italia"
4 Sverdrup Research Station
5 AWIPEV Arctic Research Base
6 Adam Mickiewicz University Polar Station
7 Czech Arctic Research Station of Josef Svoboda
8 Polish Polar Station, Hornsund

NORWAY
9 Nibio Svanhovd Research Station
10 Finse Alpine Research Centre

SWEDEN
11 Tarfala Research Station
12 Abisko Scientific Research Station
13 Svartberget Research Station

FINLAND
14 Kilpisjärvi Biological Station
15 Kolari Research Unit
16 Pallas-Sodankylä Research Station
17 Hyytiälä Forest Research Station (SMEAR II)
18 Kevo Subarctic Research Station
19 Kainuu Fisheries Research Station
20 Oulanka Research Station
21 Värriö Subarctic Research Station

SWITZERLAND
22 ALPFOR Alpine Research and Education Station Furka

AUSTRIA
23 Station Hintereis
24 Sonnblick Observatory

CZECH REPUBLIC
25 Krkonoše National Park (CZ)

POLAND
26 Karkonosze National Park (PL)
27 M&M Kłapa Research Station

RUSSIAN FEDERATION
28 Lammin Suo Research Station
29 Khibiny Educational and Scientific Station
30 The Arctic Research Station
31 Mukhrino Field Station
32 Beliy Island Research Station
33 Numto Park Station
34 Khanymey Research Station
35 Willem Barentsz Biological Station
36 Kajbasovo Research Station
37 Igarka Geocryology Laboratory
38 Aktru Research Station
39 Evenkian Field Station
40 International Ecological Educational Center "Istomino"
41 Research Station Samoylov Island
42 Spasskaya Pad Scientific Forest Station
43 Elgeeii Scientific Forest Station
44 Chokurdakh Scientific Tundra Station
45 Orotuk Field Station
46 Avachinsky Volcano Field Station
47 North-East Science Station (NESS)
48 Meinypil'gyno Community Based Biological Station

KYRGYZ REPUBLIC
49 Adygine Research Station

ALASKA, USA
50 Barrow Arctic Research Center/Barrow Environmental Observatory
51 Toolik Field Station

CANADA
52 Kluane Lake Research Station
53 Western Arctic Research Centre (WARC)
54 Canadian High Arctic Research Station (CHARS)
55 M'Clintock Channel Polar Research Cabins
56 Churchill Northern Studies Centre
57 Flashline Mars Arctic Research Station
58 Polar Environment Atmospheric Research Laboratory (PEARL)
59 Igloolik Research Center
60 CEN Bylot Island Field Station
61 CEN Whapmagoostui-Kuujjuarapik Research Station
62 CEN Radisson Ecological Research Station
63 CEN Umiujaq Research Station
64 CEN Boniface River Field Station
65 CEN Salluit Research Station
66 CEN Clearwater Lake Research Station
67 CEN Ward Hunt Island Research Station
68 Nunavut Research Institute
69 Uapishka Research Station
70 CEN Kangiqsualujjuaq Sukuijarvik Research Station
71 Labrador Institute Research Station (LIRS)

GREENLAND
72 DMI Geophysical Observatory Qaanaaq
73 Arctic Station
74 Greenland Institute of Natural Resources
75 Summit Station
76 Sermilik Research Station
77 EGRIP Field Station
78 Zackenberg Research Station
79 Villum Research Station (VRS)

ICELAND
80 Sudurnes Science and Learning Center
81 Litla-Skard
82 Kárhóll Research Station
83 Rif Field Station
84 Skálanes

FAROE ISLANDS
85 Faroe Islands Nature Investigation (FINI)

UNITED KINGDOM
86 Cairngorms

INTRODUCTION

The INTERACT Fieldwork Planning Handbook has been produced within the framework of the EU Horizon 2020 infrastructure project INTERACT. It aims to ensure that you are well prepared for fieldwork at INTERACT stations and elsewhere in the Arctic and Alpine regions, providing an overview of all important aspects related to planning such fieldwork. The book has been jointly developed by early career scientists and research station managers, combining knowledge from two different perspectives: those just starting out on their careers and those with years' worth of experience. While the main target audience of this book is early career researchers, we hope it will also be useful to anyone else involved in planning, coordinating and taking part in fieldwork at INTERACT stations and more broadly in the Arctic and Alpine regions.

The Fieldwork Planning Handbook is divided into five chapters outlining how to plan and prepare for your fieldwork, through to what you need to think about when you are in the field, and continuing all the way to what you need to think of when you have returned safely back home. Each chapter first provides a brief overview of the theme covered, and then moves on to a more detailed description of various aspects related to that topic. In addition, external contacts and online resources are compiled at the end of each chapter.

The Arctic can be a dangerous place to work if you are not well-prepared. In some areas, polar bears might be your greatest threat, while in other places it could be transportation by boat, climbing a mountain to reach your field site or dealing with rapid changes in weather conditions. Your own safety and the safety of others are paramount when doing fieldwork in the Arctic. We have therefore included a specific chapter addressing the main safety considerations that should be involved in planning any fieldwork. This chapter also includes links to a number of more specific and comprehensive publications on Arctic and Alpine safety for further information.

We cannot cover every eventuality that may arise in the planning and conducting of fieldwork, since this would be a near impossible task (and this book might become very weighty!), but we have tried our best to cover what we consider the most important aspects and hope that it provides a valuable starting point for your fieldwork preparations. This handbook is complemented by the INTERACT Practical Field Guide – a handy resource that is designed to be taken into the field as a reminder of the main safety aspects and best practices. It provides checklists, specific safety tips, first aid basics, information on emergency preparedness, and space for adding emergency contact details.

This Fieldwork Planning Handbook contains a large number of links to websites and since these often change over time, some links may not work. Should you come across 'dead links', we encourage you to search the web using the title associated with the link or to contact the relevant station or organisation behind the website. Future updates to the guidebook could include any additional points that you might feel are missing, so do not hesitate to contact APECS or INTERACT if you have any suggestions or comments for improvements.

For up-to-date information on who to contact, please consult the INTERACT website: www.eu-interact.org

Getting the most out of this handbook

- You need not read this book from start to finish. Depending on where you are in the planning phase, you can just focus on the chapter devoted to that particular aspect.
- Key considerations can be found at the start of each chapter.
- Handy tips as well as links to documents from INTERACT stations or other external resources are compiled at the end of each chapter, providing useful additional resources.

Information about INTERACT stations

When planning your field trip, you will need a wealth of information about the station that you will be visiting, e.g. about its natural environment, laboratory and workshop facilities, required field and safety equipment, permits, etc.

- For specific questions about the station, we encourage you to consult the INTERACT Station Catalogue and station website before contacting the station manager. Both station websites and contact information to station managers are available through https://eu-interact.org/field-sites/
- If you cannot find the information that you are looking for on the station website, among the planning documents provided here, or in the INTERACT Station Catalogue, you can always contact the station manager. We recommend that you collect all your questions in one e-mail.

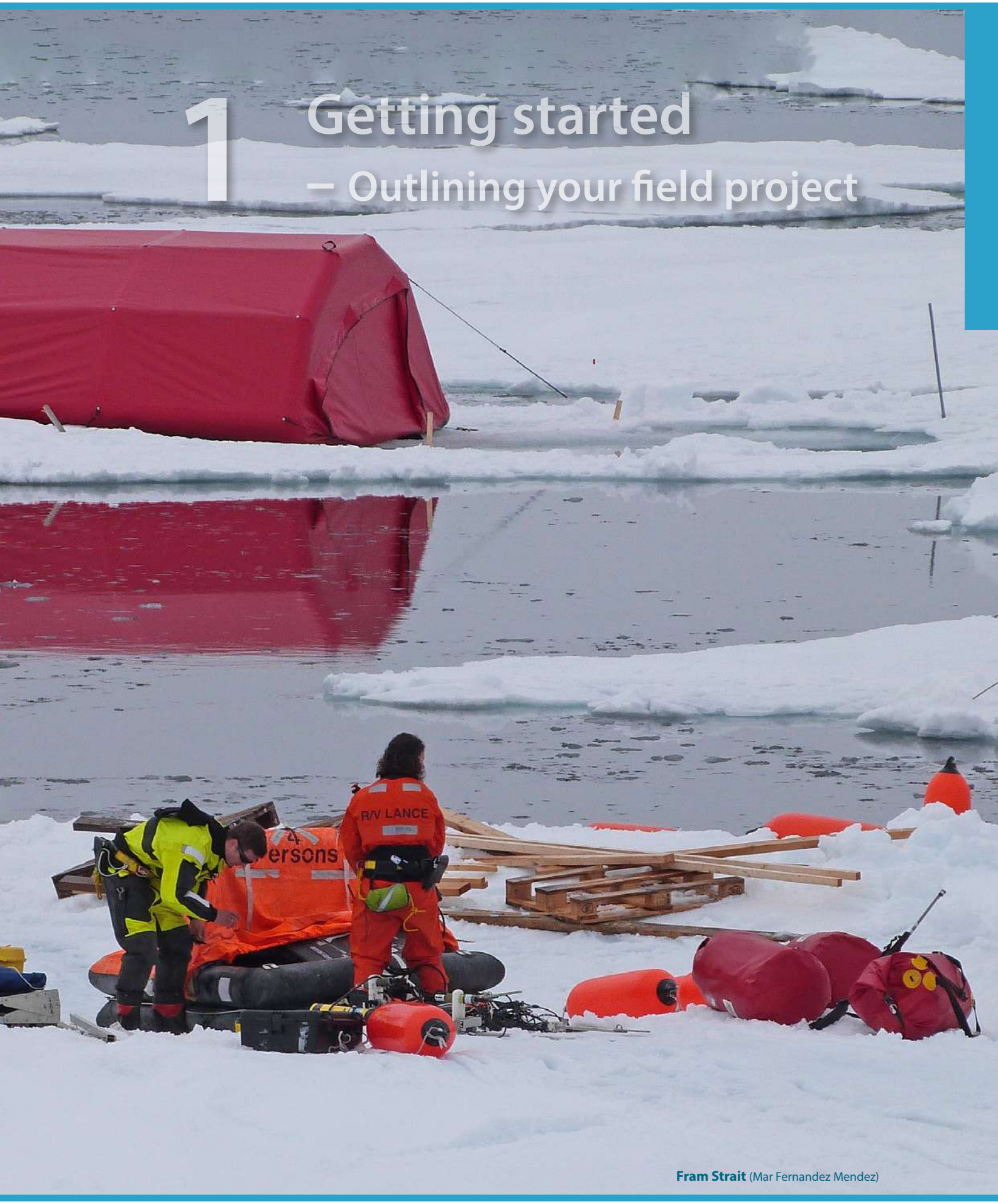
HANDY TIP
This book is supplemented by the INTERACT Practical Field Guide that provides safety related information for when you are at research stations and in the field.

Available on www.eu-interact.org

Key considerations

- Develop clear aims and ensure you add something new to the knowledge pool.
- Carefully select your field site(s), methodology, timing, and scientific equipment according to the research question(s) that you want to investigate.
- Proper risk assessment, mitigation measures and contingency plans will help you to anticipate what risks you may face and to be prepared to avoid or mitigate them.
- Keep an open mind when thinking about the time plan for your project and allocate enough time for planning activities (application and ordering procedures, training, travel, and logistics) in addition to planning your time in the field.
- Having a plan A, B, C, D, E, … is always a good idea.
- Allocate some budget for unforeseen costs.
- Explore which options for data preservation and sample storage are best suited for your project and develop a data management plan for sharing your data (e.g. open access repositories).
- Think about how to disseminate your scientific results, but also how to communicate to a wider audience about your project and why this is important in the bigger picture. This includes local communities should you be working with or near them.

1 Getting started
– Outlining your field project



Fram Strait (Mar Fernandez Mendez)

The planning phase is one of the most important parts of any fieldwork. Doing this properly will increase the likelihood of everything running smoothly, and it is the best way to avoid unnecessary challenges or incidents. Before starting any detailed planning, it is probably a good idea to brainstorm what it will take to accomplish your fieldwork. Once you have done this, you may find it useful to discuss your research ideas with fellow students, colleagues or experts in the field before making a detailed plan. This will help you to outline the different steps involved; from the planning phase through to fieldwork and analysing your samples once you are safely back home again as well as to evaluate the time needed for each step. This process will also ensure that you think through the various aspects to consider when writing your research/project plan.

The following sub-sections outline some of the main elements of a research plan. Note that if you are applying for funding and need to provide a research plan, you may need to follow a specific format depending on the particular funding agency's requirements. Keep in mind that fieldwork planning should start at least six to nine months in advance, especially if funding or permit applications are required or if you have to ship cargo to remote parts of the world.

Being well prepared increases the likelihood of achieving your aims and often result in more fun and enjoyable fieldwork (Rodolphe Merceron).

1.1 Scientific rationale and objectives

The very first step of your fieldwork planning should be to establish what you are aiming to do and why; this should be based on your own interests, experiences, and what may be expected from you. Aims or objectives are broad statements of what you hope to accomplish in your project. They should be simple but specific and clearly outline the research questions you are going to address. Be clear and reasonable with your goals regarding what you intend to achieve in the time allotted for fieldwork and the resources that you have. A well thought out and well-designed study increases the probability of achieving funding, for collecting good data, and credible results. Deciding on your aims and objectives is also important because it will help you plan all subsequent steps in your fieldwork planning, i.e. what you need to do to be successful and efficient in the field.

The rationale for your study should put your research aims into a broader context, presenting the current state of knowledge by briefly outlining results from similar studies to help provide a background for your project. The rationale should explain why your research is relevant and why it is important, i.e. what gap in our knowledge are you going to fill?

Have clear aims and objectives for your study

Aims and objectives

- What do you want to achieve with your research?
- You can have several aims and objectives.

Rationale

- Why is it relevant (how does your project fit into the 'bigger picture')?
- Why the need for fieldwork at this specific site (will it contribute with gap-filling data, new process understanding, new discoveries, etc.)?

1.2 Methods and data requirements

Knowing what data you will need and what methods you will use to collect them is an essential part of your fieldwork planning. Here a literature review can be very helpful to identify the best available methods relevant for your research (best practices), as well as to identify existing datasets for comparisons across spatial and temporal scales or to find out what background data you need to interpret your data (e.g. temperature, precipitation, etc.). It is also a good way to ensure that you are not repeating something that has already been done, and that you are up-to-date with the latest methodologies and results to ensure a proper study design at your field site.

Carefully assess your data requirements and select you methods. Typing in data in a tent while rain is pouring down outside, South Greenland (Katrine Raundrup).

Making the most of your time in the field

If time and logistics allow, it is often useful to take samples or make observations for colleagues who might not be able to get into the field, or to the particular station that you are going to visit. Make sure to inform your colleagues or any other project partners who may be interested in getting samples or observations, about your planned fieldwork. They will likely need detailed information, such as how long you will be in the field, what the station environment is like, where exactly you will be going, how much time you will have, etc. Sometimes picking up the telephone to organise these sorts of things can save a lot of time for all parties involved. Do not feel intimidated about speaking to more senior colleagues about such issues, most people will be very grateful for getting samples that they would not be able to get otherwise.

Helping others can also be a good way to expand your network and get involved in other projects. In return, they may also be more willing to help you on a future occasion. Furthermore, collecting data for others will increase your knowledge that may relate to your own research and you might even be lucky to experience that the 'extra' data can contribute to your project.

If you are going to take samples for others, it is important that this is coordinated well in advance to ensure that the correct permits are applied for and to ensure that any other logistical issues such as transport of samples, equipment, etc., are taken care of well ahead of time. Some measurements may require specific protocols or techniques and it is important that they are discussed and rehearsed before going into the field.

Remember that going into the field is mainly to collect data for your own project, and you should make this your highest priority. It is not unusual to see early career researchers extremely stressed after a month of working 12-14 hours per day because they have too much data to collect. Being in the field can be physically and mentally demanding and usually fatigue hits you after a few weeks. You need to find a good balance between work and rest to ensure that you still have energy to collect samples even after weeks in the field.

It is worth finding out what data are already available. Data from stations and visiting scientists can be available through a variety of means; some stations provide access to basic data on their websites (see also INTERACT Virtual Access on www.eu-interact.org), and some data is made available through open access data repositories or in journal papers. The best place to start is probably by contacting the station manager of the research station to ask them about similar research projects in the region and where to find relevant literature and previous data. Also, ask colleagues or collaborators, who may know more about the particular work you are planning on doing. Some INTERACT stations also provide information on what parameters are monitored at the stations (see https://interact-gis.org/).

There may also be scientific networks focused on your specific research topic or area. These networks will often provide best practice guides (e.g. sampling protocols) and sometimes a publicly available database. It may thus be useful to see if relevant networks exist and what they offer in terms of methodological advice and data. It is a good idea to search relevant thematic, national, regional, and global data repositories. For example, the World Data Center PANGAEA aims at archiving, publishing, and re-using georeferenced data from earth system research (https://www.pangaea.de/) while the Research in Svalbard database keeps track of all past and current research projects and metadata on and around Svalbard, Norway

(www.researchinsvalbard.no). For examples, see the resources section at the end of this chapter. Furthermore, it is becoming increasingly common to assign DOIs (Digital Object Identifiers) to datasets, which often are listed or described in scientific papers and provide links to the data sets used in the study.

Once you have decided what data you need and what methods are best suited to obtain them, it is good to practice any techniques and methods you may not be familiar with before you go into the field. By being comfortable with your methods, you reduce the possibility of wasting time and energy on unforeseen issues during your fieldwork and this increases the probability of returning from the field with the data you need to achieve your research goals.

1.3 What scientific equipment will you need?

Once you have established what data you need, you also need to decide what equipment your fieldwork requires. It may be useful to check through your equipment list with others who have previous experience making the same kind of measurements. It is very helpful to test your equipment thoroughly at home. Make sure you know how to use (and repair) all the equipment that you will be using, that you are familiar with the measurement techniques and that it works well in cold conditions. It is particularly important that you test your equipment, especially sensitive instruments with cables and screens, in conditions that are as close to reality as possible, such as a cold room or a freezer. Remember, it is unlikely that you will be able to get replacements for anything once you are in the field because of the remoteness of most stations. Make sure to bring some extra sample bags/bottles, spare parts, and tools. It is also important to note that certain chemicals require specific risk assessments and safety measures that need to be considered during the preparation phase.

HANDY TIP
Before you go into the field, it is advisable to practice your sampling procedure(s) in a safe, local environment that is as close to real field conditions as possible. In this way, you can learn from mistakes early – before it really matters.

Once you have identified all equipment you will need test it before leaving for the field. A researcher is searching for signals from radio collared lynx (Matthew Ayre).

A recurring problem at field stations is that the electrical power may not meet the requirements of your equipment or that electrical power may not be available at the station or where your study takes place. It is important to find out what power is available at the station (if any) and whether or not it fits your needs. You may need to consider different types of renewable energy sources (e.g. solar panels, wind turbines, or similar) to charge batteries as well as other back-up power supplies (e.g. a power bank, uninterruptible power supply/source (UPS), or generator) for equipment requiring regular electrical power systems. Furthermore, it is always a good idea to have a technician check the balance between the power you need for your instruments and the power provided by the electrical power sources you plan to use. Again, depending on the type of study, it may be a good idea to consult the station manager about this. Remember that most of the failures affecting instrument stability in the field relate to problems with the provision of electrical power.

Finally, it is not only the scientific equipment you need to think about. Your own personal gear, clothing, and safety equipment is also crucial for the success of your fieldwork.

Questions you should be able to answer before going into the field include:

- What data do you want to acquire to address your objectives?
- Are background/comparative data needed, and are these available?
- What data do you need to collect yourself and what data are already available?
- Will your data require statistical processing of any sort and what are the related data requirements?
- Will you use a model to interpret your data and what are the related data requirements?
- What methods, techniques, and equipment will you use to obtain your data?
- Are there existing standards that will make your data compliant with other research initiatives and comparable to other sites (e.g. sampling protocols provided by scientific networks)?
- What equipment is available at the station and what equipment do you need to bring from home?
- Will your equipment work under the climatic conditions at the field site?
- How will you set up your experiment?
- Does the instrumentation need electrical power and how can you get this?
- How will you minimise the environmental impact of your research?
- Are there storage facilities for your samples, such as a cooling room or freezer? What are their temperatures and capacities?
- Are there laboratories for handling samples and performing experiments?
- Where will the data be preserved and how will they be shared (see section 1.8)?

1.4 Study site(s)

When considering where to conduct your research you will need to think of a wide range of different factors, including:

- What environment do you need for your fieldwork (e.g. glaciers, tundra, wetlands, etc.), and which stations provide such an environment?
- When is the best season to go?
- Are relevant background or comparative data available?

- Are there particular timing considerations that are important for your research? For example, when does the sea-ice usually break up or when does the flowering season begin?
- Does the station have the facilities you require for your fieldwork (e.g. laboratory space, measurement sites, transport options, etc.)?
- How much will it cost to get you, your team, and your equipment to the station? How much will it cost to stay at the station?
- Are you going to stay at the station and work in the area or are you going to stay at a field camp further away? How long will you stay there? Are you going to visit multiple sites and establish field camps there?

A good place to start looking for this kind of information is the INTERACT Station Catalogue (available through www.eu-interact.org). This briefly describes each station, including facilities, local climate, natural features, what equipment is available and how to get there. In addition, you can also make use of a wide variety of tools such as Google Earth, satellite data or GIS data to help you select the most appropriate field site. INTERACT has also developed special features such as short station videos and 'Street View' (360° images) of stations, their interiors (laboratories, workshops, etc.) and surroundings that can help in the selection process. Again, consider drawing on the expertise of the station managers to find out more about local conditions, environmental features, species distributions, etc. It may be useful to have an alternative list of field sites and/or stations to visit, in case that you are not able to get access to your first choice.

Once you have decided which station(s) you would like to visit, you will also need to carefully consider when to go. Here it is also usually advisable to have a 'Plan B', i.e. reduced study programme, two possible periods or two equally appropriate stations, since you may not get access to your preferred station or for the dates you want. Note that some stations have annual deadlines for applying for access, while others accept applications all year around. Either way, be aware that application procedures can take a significant amount of time, and that you may need additional time to obtain visas or other permits from authorities (e.g. for accessing protected areas, handling wildlife, local authority permits, permits to export samples, etc., see resources of chapter 2).

Carefully select your field site(s) and when to go, but keep a plan B, C, D and possibly E in mind. Near Ny Ålesund, Svalbard, Norway (Eleonora Conca).

Getting information about access to and working at the research station

Visit the station website early in the planning process and contact the station manager if you cannot find all relevant information. Station websites and managers can provide a wealth of information about accessing the station, its surrounding environment, data availability, and anything else you may need to know. They can be one of your most useful resources in the planning process. However, you may need to be patient, when contacting the station manager – not all stations have good internet connections and during the main field season they may be very busy.

If you cannot find the relevant information on station website or catalogue, make sure to ask the station manager all relevant questions in one e-mail, for example:

- What are the stations' application procedures and and what additional permits are needed?
- What safety training is required for you and your team? Can the training be done at the station or does it need to be completed before arrival?
- What safety equipment are you required to take to the station and what is available there?
- What personal clothing and equipment do you need to bring?
- What transportation is available to and from the station, and to field sites?
- What means of communication are available at the station and for use in the field?
- What kind of storage, laboratory, and workshop facilities are available at the station?
- What kind of power supply is available (if there is one at all)?
- What kind of internet connection is available at the station? Does it cost anything?

A more extensive list of questions you may need to ask the station manager can be found in Appendix A.

Remember that stations differ considerably and that good contact with the station manager can be key to ensuring you are well prepared and your field project will be successful.

1.5 Risk assessment

It is important that you are physically and mentally capable of enduring the environmental and climatic conditions that you will meet in the field. You need to be honest with yourself and your team about what to expect in the field and your abilities to deal with anything that might happen. Large differences between expectations and abilities can mean putting yourself and your team at risk – possibly quite serious risk. Accidents or illness in the field can have much more serious consequences, particularly because most INTERACT stations are hours or possibly even days away from the nearest well-equipped medical centre. Furthermore, the costs of Search and Rescue operations can be high and the logistics related to them are extremely challenging. Everything possible needs to be done to prevent accidents occurring in the first place: risks need to be avoided by maintaining large safety margins.

Taking the time to do a proper risk assessment can be incredibly important and it is highly recommended no matter how long you will be in the field or where you are going. Mental preparedness, good planning, and implementing measures in order to prevent incidents from happening is a much better strategy than having to deal with the consequences of an accident. Furthermore, a risk assessment can also be used more than once, serving as a starting point for future fieldwork. There is extensive literature on this topic and some further reading is provided in the resources section of this chapter. Many universities also have Health and Safety departments who can offer guidance in this respect.

There are essentially four aspects involved in carrying out a risk assessment, all of which are equally important. The following section briefly describes each of these elements.

1.5.1 Risk identification

The first step in any risk assessment is to identify the main risks. This is something that may sound easier than it is in practice and it is good to take some time to think about all possible risks, no matter how improbable they may seem. The initial aim should be to clarify potentially unsafe activities, before going on to assess how to mitigate them in the next stages. A few of the potential risk areas that you may want to think about include:

- Transport to the area and travel in the field:
  - Aircraft
  - Boats
  - Snowmobiles
  - Vehicles (Cars, ATVs)
- Being in the field and at the station:
  - Working in cold temperatures
  - Fieldwork methods, scientific equipment, and chemicals
  - Workshops, laboratories, and tools
  - Fire, electricity, cooking, and water treatment
  - Field camps
  - Health and hygiene
  - Firearms
  - Cultural issues and differences
- Natural environment:
  - Weather and weather changes (temperature, precipitation, wind, fog that limits visibility)
  - Natural hazards unique to the region or season (e.g. sea-ice, glaciers, steep terrain)
  - Wildlife
- Communication and navigation equipment:
  - Ability to communicate in remote areas and high latitudes

HANDY TIP
A good way of thinking about possible risks is asking yourself "what if?" questions.

Once you have compiled an initial list, it may be useful to discuss this with more senior colleagues or even the station manager. They may be able to help you identify other risks or challenges that you might not have thought of.

Risk identification is the first step in the risk assessment process. Aerial view of crevasses on the Greenland Ice Sheet; one of many risks you may encounter in the field (Morgan Seag).

1.5.2 Risk assessment

There are various ways to do risk assessments. A full risk assessment goes beyond just identifying risks; it investigates and evaluates each risk. This involves assigning each risk a particular probability and consequences, or in other words, assessing the likelihood and consequences of each risk (see Figure 1.1). The probability of a risk is related to how likely that risk is to occur, ranging from improbable to frequent. The potential consequences of a risk indicates what the potential impact of that risk might be, ranging from negligible to severe. The probability and consequence of each risk determine its impact on the field project/team (Table 1.1).

The second step is to place each of the risks that you have identified into the risk matrix (Figure 1.1). It will highlight the risks that you need to focus more attention on. Note that you may need to revise the risk assessment as risks and appropriate mitigation actions can change over time, even when out in the field, and it can change depending on the team that you will be working with.

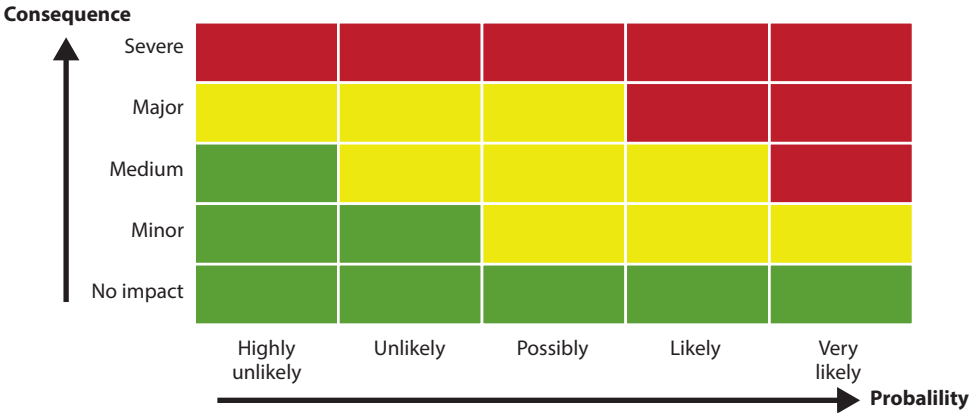


Figure 1.1 Example of a risk matrix showing probability and consequences of risks ranging from minor/unlikely (green) through to severe/very likely (red) impact on the project and/or field team.

1.5.3 Risk mitigation

The third step is to decide which measures you might need to take to eliminate or reduce any of the risks that you have identified, focusing on those that are more likely to occur and with more serious consequences (Table 1.1). In some cases, there might not be much that you can do to mitigate a risk, but rather you need to stay aware of that risk and monitor if it becomes more serious (this is often called residual risk).

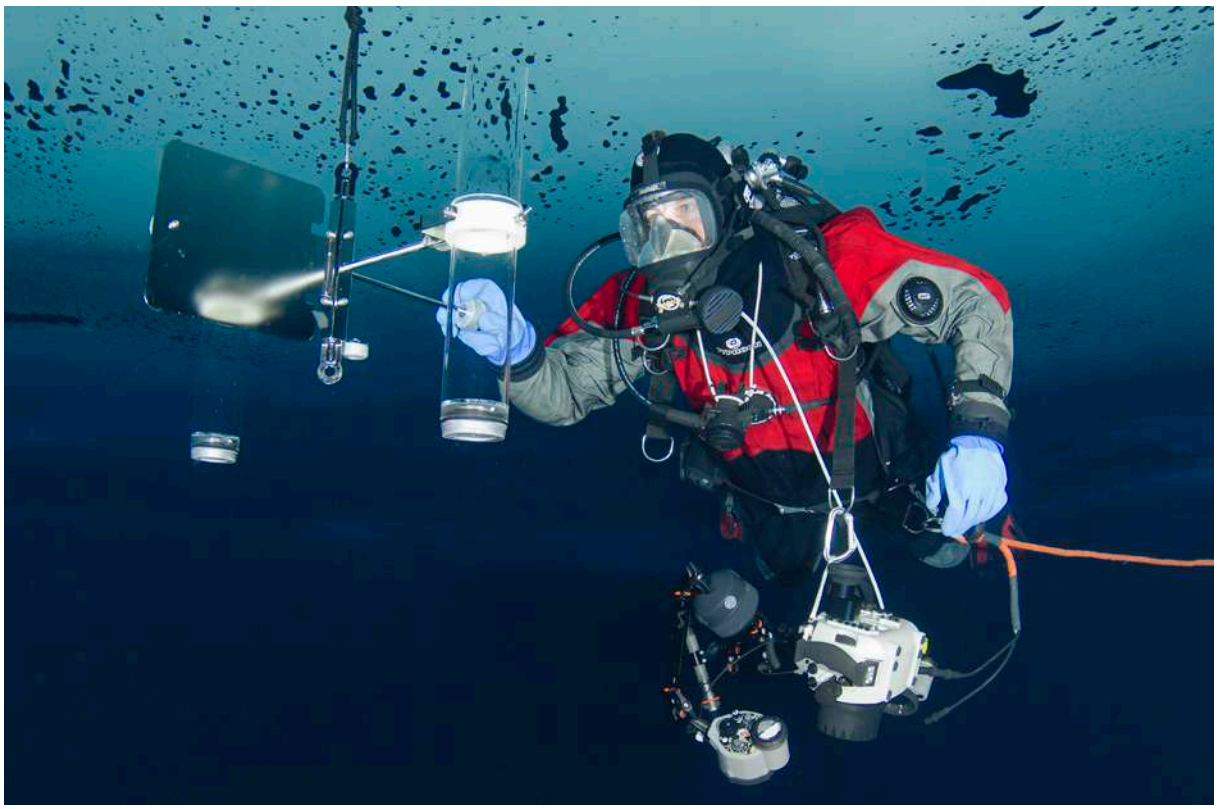
Ask yourself what can be done to avoid or reduce the risk?

- Can you modify the activity in the planning phase or in the field to reduce or avoid the risk (e.g. cancel activity, change methodology or shift activities to another area/ period)?
- Can you use technical means to minimise risks in the field (e.g. bring specific technical aides; radio, weapon, safety gear, etc.)?
- Can you reduce the impacts should any incidents occur (e.g. train and follow emergency procedures for station and field activities)?

Hazard/ Risk Description	Probability			Consequence			Impact	Mitigation actions	Responsibility
	1	2	3	1	2	3			
Zodiac journey to field site, outing for 1 day									
Cold temperatures			x		x		**6**	Sufficient warm clothing	All members of the field team
Weather deterioration forecasted (strong winds)			x			x	**9**	Obtain latest weather forecast, be prepared to change to another day or an alternative area	Team leader in consultation with station manager or staff
Ice/drift wood in water		x			x		**4**	Adjust driving speed accordingly	Zodiac driver
Engine failure	x					x	**3**	Performing regular maintenance, spare parts and engine oil on board	For equipment borrowed from the station: Station manager or staff
Man or equipment over board			x			x	**9**	All team members wear immersion suites, secure cargo	All members of the field team
Polar bear/walrus near landing site			x			x	**9**	Obtain latest information about large mammal sightings in target area, scan area with binoculars prior to landing, establish a bear watch as one of the first people going on land, be prepared to change to another day or an alternative area	Team leader, but also all other members of the field team
Firearms on board the zodiac			x			x	**9**	Firearms have to be unloaded and packed, ammunition stored away	Team leader, but also all other members of the field team
Outcrop mapping near the beach, 1 day									
Cold temperatures, wind			x		x		**6**	Sufficient warm clothing, spare gloves and hat, warm drinks	All members of the field team
Steep terrain with loose rock, 5 m high		x			x		**4**	Wear helmets, sturdy boots and gloves	All members of the field team
Polar bear tracks observed in the area a few days ago			x			x	**9**	Scan the area with binoculars, establish a bear watch, be prepared to change to another day or an alternative area	Team leader, but also all other members of the field team
Firearms present			x			x	**9**	People handling the firearms need to have completed training, move away from group when half loading or emptying the firearms	All members of the field team

Table 1.1 Template example for a risk assessment process showing examples for different scenarios, the associated risks and the mitigation measures. They may be incomplete and the evaluation of probability and consequences is somewhat subjective. The number coding for probability and consequences is: 1 – seldom/little; 2 – likely/considerable; 3 – often/severe. Impact = Probability × Consequence.

Hazard/ Risk Description	Probability			Consequence			Impact	Mitigation actions	Responsibility
	1	2	3	1	2	3			
Crossing sea ice with a group on snowmobiles, distance ca. 20 km, the route is seldom used									
Areas with thin or bad quality sea ice			x			x	**9**	Obtain latest weather forecast and reports on ice conditions, bring all required emergency equipment, ice spikes ready, constantly test ice thickness and quality, be prepared to change to another day or an alternative area	Team leader in consultation with station manager or staff
Weather deterioration forecasted			x		x		**6**	Obtain latest weather forecast, be prepared to change to another day or an alternative area	Team leader in consultation with station manager or staff
Obstacles in sea ice		x			x		**4**	Adjust driving speed according to visibility	All members of the field team
Slush or water on the ice		x			x		**6**	Keep distance when driving, observe scooters in the front and back, when encountering slush – speed up, keep the speed, make a big turn back to safe ice, do not stop before reaching safe ice	All members of the field team
Sledge tips over		x		x			**2**	Adjust driving speed, secure load	Scooter drivers that pull sledges
Cold temperatures, wind			x		x		**6**	Sufficient warm clothing, spare gloves, warm drinks	All members of the field team



Diving in arctic waters is a high risk activity and should only be done by trained and experienced divers using appropriate equipment and safety measures (Peter Leopold).

Some risks might be mitigated easily, for example, by taking extra gear and/or sampling equipment with you. Other risks may require more extensive planning and training, for example, if your study area is located in polar bear country you will need specific training (e.g. learning about the natural behaviour of polar bears and how to use polar bear deterrents or a firearm). Give some thought to whether there are other approaches to doing things that might lessen the risk. Also, do not be afraid to renounce doing something if you feel a particular activity is too risky during the risk assessment or in the field.

A wide range of companies use the so-called "bow-tie model" for the visualisation of risk-prevention and mitigation strategies (Figure 1.2). The model separates causes and consequences of a risk, with risk-prevention measures on the left-hand side, and mitigation measures on the right-hand side. Due to the remoteness of many INTERACT field stations, which makes access to professional medical support challenging and expensive, we strongly recommend identifying and implementing adequate measures (often called "barriers") to avoid incidents occurring in the first place. In other words, focus on staying on the left-hand side of the "bow-tie" model. Chapter 3 in this book addresses a wide range of safety considerations relating to field work in the Arctic and at high altitude. You may want to read this chapter carefully before starting your risk assessment.

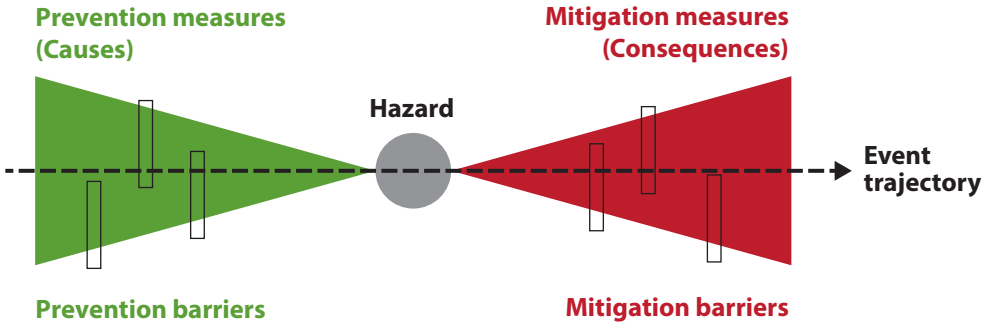


Figure 1.2 The bow-tie model visualises strategies for risk-prevention and mitigating the consequences. The model separates causes and consequences of a risk, with risk-prevention measures on the left-hand side and mitigation measures on the right-hand side.

1.5.4 Contingency plans

The final step in the risk assessment process is to establish what should happen in case one of the identified risks becomes reality despite the prevention measures you have put in place (Table 1.1). This may include actions like appointing a leader and co-leader for emergency situations, knowing who to contact and how, etc. At this point you may also want to consult chapter 3, which covers this subject in more detail.

Most stations have emergency procedures in place and these should be communicated clearly to users of the station. If not, ask the station manager and familiarise yourself and your team members with procedures and technical equipment before leaving for the field.

1.6 Time schedules

1.6.1 Logistical organisation

Once you have identified a suitable field site, the best season to go into the field and are familiar with your risk assessment, you will need to get down to organising the logistics of your fieldwork. This is more completely covered in chapter 2, but here we mention that you need to plan time for some or all of the following activities:

- Applying for access to the station(s).
- Applying for visas/permits for accessing areas, extractive sampling and wildlife handling, sample transport, etc.
- Training activities (sampling protocols, safety training, etc.).
- Ordering equipment, including consumables and chemicals.
- Arranging transport for both yourself and your equipment.

1.6.2 Fieldwork activities

When planning your fieldwork, make sure you allow enough time for travel, becoming familiar with the facilities and procedures at the station, and for reconnaissance of field areas. When it comes to the schedule for your actual fieldwork, allow enough time for bad weather days, as well as cleaning and packing up your gear and samples at the end. Include a Plan B, i.e. reduced study programme or alternative location (and possibly even a Plan C, D, E, F, and more). It is very normal that things do not work quite as planned in the Arctic, and it is essential to remain flexible and responsive. This is particularly important because when things do not work out as planned it is easy to become stressed, unfocused, and as a consequence incidents or accidents are more likely to occur. However, those who have carefully planned things are much better prepared for handling unforeseen situations if they already have a backup plan.

HANDY TIP
Keep in mind that in cold temperatures, rugged terrain, and potentially darkness even simple things tend to take much more time than at home.

Use a Gantt Chart and a 'to do list' to help you visualise your plan and organise things appropriately. It may be useful to put these up where you will often see them, e.g. on your personal bulletin board. This should ensure that you remember all steps in the preparation phase, including important deadlines. If you are lucky, colleagues might also give you handy suggestions and be able to help you.

1.7 Project budget

A detailed budget for your project is essential. It may be helpful to ask senior colleagues or collaborators for help with this and for past examples that will give you an idea of the costs. A good place to start looking for this sort of information is the station's website, which will usually list costs related to accommodation, food, transport, visas, etc. It is quite usual for unplanned things to happen when you are out in the field, particularly in the Arctic, and often researchers add an extra 10-50% to the calculated budget as a means to cover 'unforeseen costs' (the amount depends on the uncertainty related to the fieldwork in terms of climate, transport costs, etc.). This is something that funding agencies may have specific guidelines about though, so it is important to check what is possible.

1.8 Data and sample management

Remember that your data is the foundation of your research. In a hundred years, your scientific papers may be of limited interest but your data may be important for longer time series analysis. Therefore it is important that you carefully plan how you will document, share and preserve your data, e.g. in open access archives/databases, or by assigning digital object identifiers (DOIs) to your dataset. Note that your institution, authorities, and funding agencies may have policies regarding data preservation and sharing. For example, data collected as part of NERC-funded projects need to be entered into the UK Polar Data Centre (www.bas.ac.uk/data/uk-pdc).

You may also be required to submit physical samples (e.g. soil, rock, animal, plant or water samples) to an archive or a database at your institution or elsewhere.

1.8.1 Data management plan

More and more funding agencies require data management plans as part of proposals or as project deliverables. These plans are covering how the data will be documented, preserved, made public, how the data will be licensed for reuse, how discovery metadata (data describing the dataset) will be made available, etc. By identifying early on in the project what the important information to preserve is, the data and discovery metadata can be formatted and documented appropriately. Usually, data in its raw form is most desirable, although quality checks and controls obviously need to be run and documented to ensure that all data are as accurate as possible. This also emphasises the need for versioning and provenance of your data.

1.8.2 Sample labelling

Once you have designed a sampling strategy, decide on how you will label datasets and physical samples. Keep in mind that your work may be part of a bigger project and that there may be different types of samples collected from the same site. This may mean that you are required to label the data/samples in a specific way. Make sure, however, that you label your data and samples in a unique way, allowing you to identify them at any step during processing (i.e. from sampling until they have been archived – even if they become mixed up with somebody else's samples).

Consider that it is also important to be able to link datasets and physical samples if datasets are generated from the samples. In this context, using universally unique identifiers (UUIDs) or even data codes such as QR codes simplifies traceability and is still quite easy to achieve. The online platform GitHub (https://github.com/) may be a useful resource for software solutions for sample labelling.

Taking photos of samples, sampling sites, instrumentation, the work involved in doing the sampling, etc. can also be part of the data management plan and can be helpful for later documentation or interpretation.

Make a list of the samples you collect

We recommend preparing sample lists. This will:

- Give you an overview of all the physical samples that you have collected.
- Be helpful for ensuring that your sample collection is complete when packing and preparing shipment.
- Ease completing any customs-related paperwork that may be needed when exporting/importing samples between different countries.
- Help ensuring that all samples are treated together after return.

1.8.3 Field instrumentation

Your study may require setting up field instrumentation (e.g. data loggers, time lapse cameras, camera traps etc.) for the duration of your fieldwork or even for more than one season. When planning a study that requires field instrumentation, contact the station manager about any rules and limitations concerning field installations and ensure you obtain the relevant permits, if required. There may be other installations in the same area and you should avoid interfering with them. Wildlife, in particular foxes, may be attracted to instrumentation, so make sure that they cannot bite through cables etc. To reduce damage and plastic garbage in the environment, you may need to cover all cables, for example, with rocks.

Remember to test your equipment, especially sensitive instruments with cables and screens, in conditions that are as close to reality as possible, e.g. a cold room or a freezer. Make sure to remove all installations, marks and other material used at your study sites after your project has finished. If you will return to the same site later, mark its position using your GPS.

Field instrumentation in Adventdalen, Svalbard, Norway, to measure greenhouse gas emissions in tundra bogs that are underlain by permafrost (Andrea Schneider).

As a researcher you have an inherent responsibility to take care of the natural environment wherever you are doing your fieldwork (Ruth Vingerhagen Hindshaw).

1.9 Environmental compliance

You may be required to provide documentation regarding how your fieldwork complies with environmental regulations in the area you are going to. This is particularly the case for protected areas such as national parks or nature reserves. Find out from the station manager if there are any particular regulations that need to be adhered to and what paperwork might need to be completed before you get permission to work in this area.

Certain funding agencies, for example the US National Science Foundation, require that you complete an environmental review before your project is even approved. Make sure that you complete the relevant documentation in time; delays could endanger your field season and possibly even your entire project.

Remember that as a researcher you also have responsibility for how you carry out your work. You need to ensure that your project does not harm the fragile Arctic or northern Alpine environment and the communities which you are lucky to visit.

1.10 Output

Think about what publications you would like to produce and what information you need to accomplish this (e.g. existing data, additional new data, illustrations, photos, maps, etc.). Also consider what outreach channels you can use to share your research with the scientific community, local communities, the general public, etc. (e.g. talks, posters, blogs, newspaper articles, etc.). It can be very rewarding to share your research with the wider community, so you may want to think about using social media or other online platforms to make 'posts from the field'. This can also be a great way for friends and family to share a part of your experience.

Social media or blog posts can be used to let family, friends and colleagues learn about your adventures and experiences (https://arcticresearch.wordpress.com/).

CHAPTER RESOURCES

For more information about stations and available infrastructure:

- INTERACT GIS – find stations with specific natural features, studied disciplines, monitored parameters (or gaps) and research project metadata:
  https://eu-interact.org/field-sites
- The INTERACT Station Catalogue – a complete list of INTERACT stations including information about location, website, contact information, facilities, equipment, access, climate, environmental features of scientific interest, etc.:
  https://eu-interact.org/field-sites
- The INTERACT Data Management Plan:
  https://eu-interact.org/app/uploads/2017/11/D4._1_v1.pdf
- The University of the Arctic infrastructure catalogue – a list of arctic universities and other infrastructures:
  https://research.uarctic.org/resources/research-infrastructure-catalogue
- FARO – Arctic research infrastructures and national operators from >20 countries with activities in the Arctic:
  http://faro-arctic.org/
- CNNRO – full information about the Canadian Network of Northern Research Operators:
  http://cnnro.ca
- ISAAFFIK – The Arctic Gateway. Information on infrastructure, projects, logistics, courses, and jobs in Greenland:
  www.isaaffik.org
- SITES – the website of the Swedish Infrastructure for Ecosystem Science:
  www.fieldsites.se/en-GB
- SecNet – the Siberian environmental change network, an open community of universities and research institutes focused on research in Siberia:
  www.secnet.online/home-eng.html
- The Svalbard Science Forum has information about working on Svalbard, Norway, and accessing the research stations there:
  www.forskningsradet.no/prognett-ssf/Home_page/1253969737234
- Research coordination of Ny Ålesund and management of the science village by Kings Bay:
  http://kingsbay.no/ and http://kingsbay.no/research/nysmac/charter/

For more information about available data:

- INTERACT Virtual Access – links to online open access repositories with scientific data from station offering this:
  https://eu-interact.org/accessing-the-arctic/virtual-access/
- World Data Center PANGAEA – operated as an Open Access library aimed at archiving, publishing, and re-using georeferenced data from earth system research:
  https://www.pangaea.de/
- Polar Data Catalogue – an online metadata repository, where you can search for polar datasets:
  www.polardata.ca
- Nordicana D – an online data repository, where you can find a range of arctic datasets:
  www.cen.ulaval.ca/nordicanad/en_index.aspx

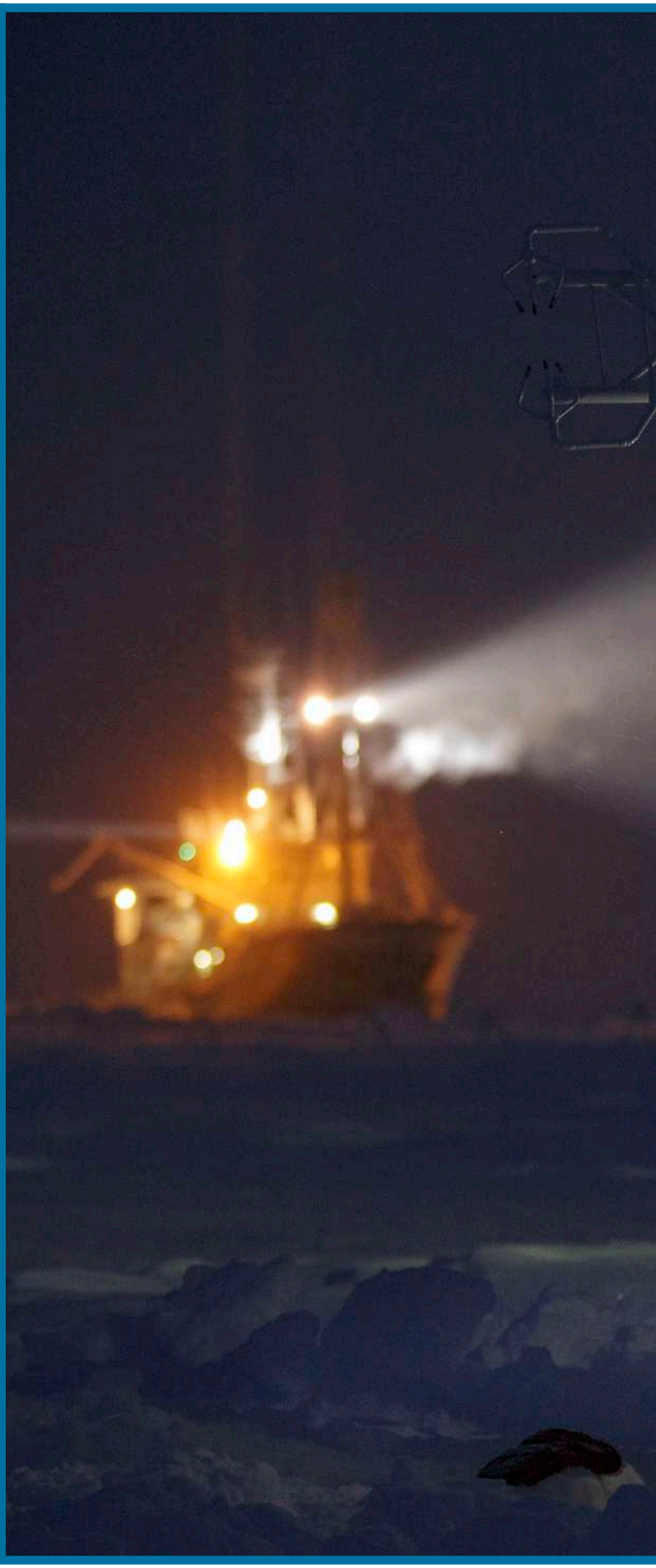
- Research in Svalbard database – keeping track of all research projects and metadata (past and current) carried out on Svalbard, Norway:
  www.researchinsvalbard.no
- Greenland Ecosystem Monitoring Programme – online datasets from three locations in Greenland:
  http://g-e-m.dk
- UK Polar Data Centre:
  www.bas.ac.uk/data/uk-pdc
- The US National Science Foundation's Arctic data archive:
  https://arcticdata.io/catalog/#data

Overall guides about research planning and data management:

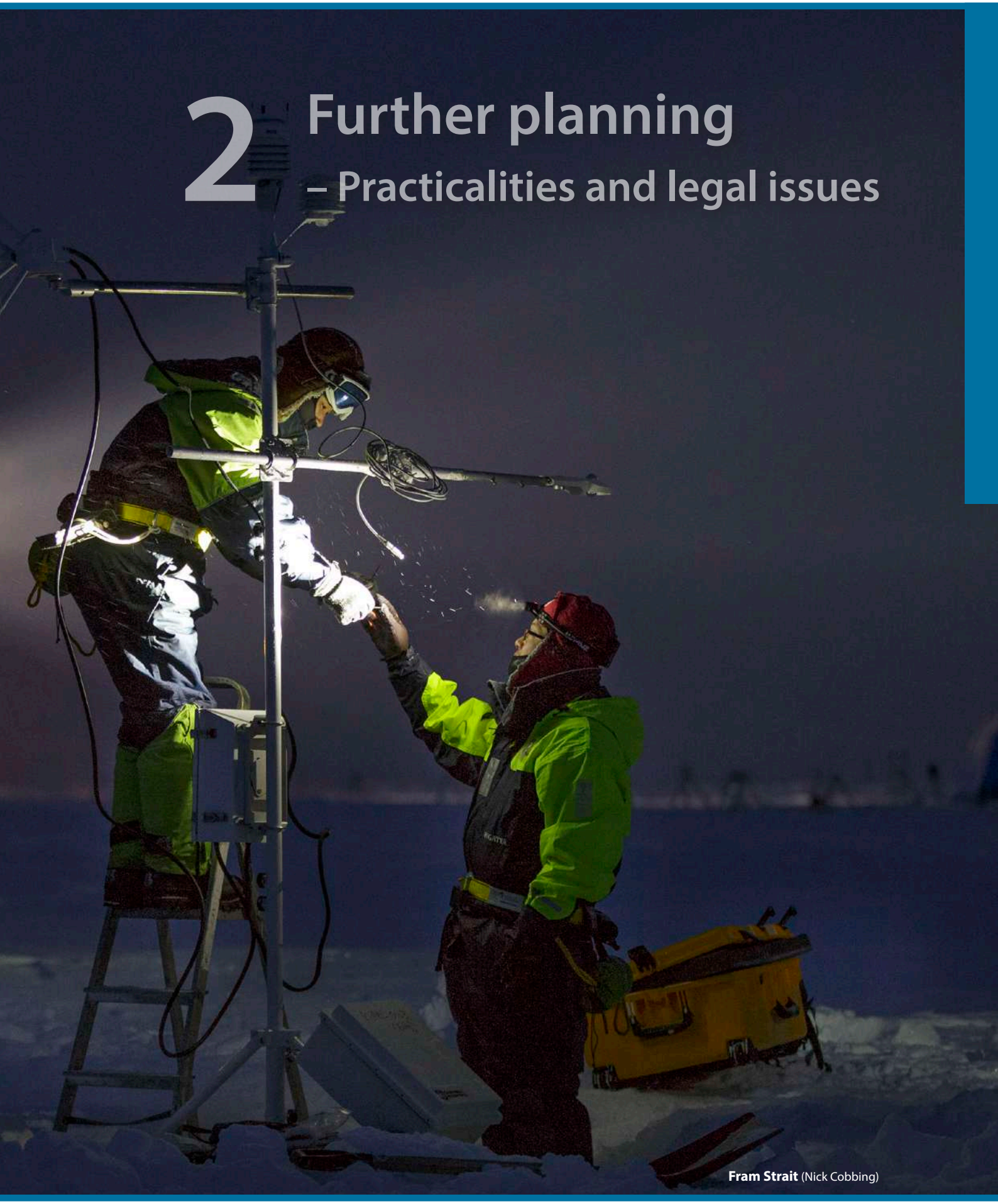
- FAIR Guiding principles for scientific data management and stewardship:
  www.go-fair.org/fair-principles/
- Registry of research data repositories:
  www.re3data.org
- Norwegian Research Council's research planning guide:
  www.forskningsradet.no/prognett-ssf/Planning_your_research/1254013985666
- APECS data management webinar:
  https://vimeo.com/291770699
- From the idea to the expedition – some planning guidelines from the Alfred Wegener Institute:
  www.awi.de/en/about-us/logistics/information-for-expedition-participants.html
- Advice on how to make a good budget from the UK NERC:
  www.arctic.ac.uk/uk-arctic-research-station/how-to-apply/costs
- An A-Z guide to doing fieldwork in Greenland, produced by CH2M Hill Polar Services:
  www.geosummit.org/sites/default/files/docs/GreenlandGuide2017.pdf
- A collection of links related to risk management from the Forum of Arctic Research Operators:
  http://faro-arctic.org/infrastructure-management-and-operation/
- The online platform GitHub may be a useful resource for software solutions for sample laballing. Is is a web-based hosting service for version control and is commonly used to host open-source software projects. GitHub provides free accounts, access control, several collaboration features, and wikis for every project:
  https://github.com/

Key considerations

- Keep a close eye on station application deadlines and funding opportunities for access, e.g. INTERACT Transnational Access calls.
- Checklists are your best friends. Use them for e.g. planning, packing, and shipping purposes.
- Arrange visas, permits, travel, and equipment transport early.
- Regulations for import and export and for transporting hazardous, cooled, or frozen goods deserve special attention so that the journey with all your equipment and samples will be smooth.
- Plan and undertake necessary training activities before heading to the field, either before you leave home or at the station.
- Remember to check travel and health insurance for you and your equipment.
- Arrange medical check-ups and vaccinations and find out how to handle chronic illness, allergies, and medication should you need to do so.
- Make sure to arrange all financial and administrative issues for the time you will be away.



2 Further planning – Practicalities and legal issues



Fram Strait (Nick Cobbing)

Most fieldwork planning needs to be done before you leave home. Proper organisation is especially important for fieldwork in the arctic regions. Their remote location prevents you from having additional equipment supplied once you are in the field (Morten Rasch).

Once you have developed a comprehensive research plan you need to start thinking about all the logistical details that will make your project a reality. This is especially important for projects in Arctic and northern Alpine regions since in most cases you will not be able to get supplies or any additional equipment (e.g. science equipment and safety gear) once you are out in the field. This chapter provides an overview of many of the important details you need to consider to carefully plan for all eventualities before you leave home.

2.1 Applying for access to the station

Most likely you will have to apply to visit the station where you would like to do your research. It is important that you start this application process early since most stations require that you apply for access several months in advance. Ensure that you are aware of and keep track of all deadlines while you are planning and organising your fieldwork.

Your first entry point to all INTERACT stations is the INTERACT website, https://eu-interact.org, where you can find information about all the INTERACT research stations. INTERACT also offers Transnational and/or Remote Access to many of the network's stations (https://eu-interact.org/accessing-the-arctic/tacall), respectively. These calls provide the possibility to visit some of the INTERACT stations (via Transnational Access) or funding for the station staff to take samples for you (via Remote Access). They are excellent opportunities for early career researchers to get some of their fieldwork funded, and it is well worth applying. Again, should you have any queries about making an application to visit a station, contact the station manager – they are there to help you.

2.2 Transport to the station and conditions for visiting

2.2.1 Access to the station

Access to a station can range from an easy drive with a regular car to flying in with a chartered ski-equipped aircraft. Costs of transport and accommodation thus vary with location (remoteness, services offered, country, etc.). Schedules of transport companies may vary, e.g. the Ny Ålesund research village on Svalbard, Norway, is connected to Longyearbyen by only two flights per week with a small aircraft and the seats are often booked long in advance. Thus, it is essential that you find out how to get yourself and your equipment to and from the station at an early stage and how much this will cost. This information is usually available on the station website, but if in doubt about anything make sure to contact the station manager.

2.2.2 Conditions for visiting

Each station will have particular conditions for visitors and it is important that you find out about their particular policies regarding e.g. safety training and equipment, insurance requirements, manipulation experiments, use of different chemicals in the field, etc. This information can usually be found on the station's website or by directly asking the station manager.

Some INTERACT stations may be close to settlements and fairly easy to get to while others might be very remote. Proper planning how you and your equipment will get to and back from the field is an important part of your fieldwork preparations (Gwenaëlle Gremion).

2.3 Visas and permits required by national authorities

Any application for permits should be made well in advance and this should be one of the first things you consider after you have developed your research plan. Depending on the region, you may need to do this in parallel with applying for access to the station and for visas, if those are required. It is also important to remember that such paperwork can sometimes be costly and this needs to be included in your project budget. You find a wealth of information for the arctic countries in this chapter's resources.

2.3.1 Visas

Depending on where you are planning on going and what passport you hold, you may be required to obtain a visa for the country that hosts the station you want to visit. This is something that needs to be arranged well in advance since some visas take weeks (or possibly even months) to obtain. Often, you may need an invitation letter from the station you want to visit to get your visa. Make sure you allocate additional time for this. You will find more information on the websites of relevant embassies or consulates.

2.3.2 Permits

You may be required to obtain permit(s) or approval(s) from national or local authorities or local communities for various activities such as collecting plants, wildlife handling, establishing field installations or sampling genetic resources. You may also be required to have a permit for entering a particular area (e.g. a national park), for using drones or for importing/exporting equipment and samples. First check the station website which permits you will need and whether you need to apply for them yourself, or if this can be done by the station. If this information is not found on the website, consult the station manager who may also be able to provide links and/or contact information to the relevant authorities and local communities.

Make sure you arrange all permits required for your field project at an early stage (Lawrence Hislop).

Discussing your project with local community representatives can focus on the scientific work, local environment and safety issues. It can be a beneficial experience for everyone involved and is highly encouraged in regions where you will be working on locally-owned land or in close contact with local communities (Morgan Seag).

2.4 Working with local communities

For work near or around local communities, it can be very valuable to plan a trip to the community to meet with them and present your research ideas both before your field season and after your fieldwork is completed to let them know what you have found. Presenting your results is a critical part of knowledge exchange with communities and it is often left out of project planning. Plan these trips well ahead and secure funding for this part of your fieldwork. Engaging local communities in your project is a great way to promote your research and to learn things you would otherwise never have learnt; but this must be planned well in advance and budgeted for. Discussing your project with local community representatives can focus on the scientific work, knowledge gaps, local environment, and safety issues. It can be a beneficial experience for everyone involved and is highly encouraged in regions where you will be working on locally-owned land or in close contact with local communities. First, though, make sure to familiarize yourself with local culture and consult the station website or manager for best practices for engagement to ensure this is a respectful and mutually beneficial experience (see more in section 4.6). In addition, in some countries local communities need to be consulted for research and sampling permits. You find more information on this in the chapter resources.

2.5 Equipment transport

To get your field equipment with you to the station you may need to fly it in, drive it in, have it transported by boat or by a combination of any of these. It is important to be aware of any restrictions related to transportation of your equipment, whether it be related to weight, size, customs, hazardous or cooled/frozen substances.

HANDY TIP

It can be a good idea to take a photo of everything that you bring into the field with you. This will be useful once you are in the field as a means to remember what you have brought with you (you might have packed several boxes weeks before getting to your field site) and to ensure that you pack everything when you prepare your journey home.

Sending freight by ship is a lot cheaper than by airplane, but it almost always takes longer. To avoid paying excess luggage fees on aircraft you may want to consider sending your equipment ahead of you (if, of course, this is possible). This probably means that you need to have everything packed several weeks before you depart yourself – and for more remote places, maybe even earlier. Tracking numbers and packing lists of all your cargo are useful to follow the shipping of your equipment to the field site. Make sure that you also have all the right permissions and paperwork to get your equipment in and out of the country you are visiting and to get your samples home (see also section 2.7).

To get your field equipment with you to the station you may need to fly it in, drive it in, have it transported by boat or by a combination of any of these (Morten Rasch).

Transport of cargo to a field site needs to be well arranged and proper packing is essential. Villum Research Station, Northeast Greenland (Morten Rasch).

Packing your equipment properly

All of your equipment, whether it be scientific or personal, should be properly packed, before it is transported into the field. Here are a few tips to help you make sure that everything arrives safely and in good condition:

- Pack things tightly in sturdy boxes (e.g. Zarges boxes) so that things cannot shake around and get damaged.
- Label all packages properly (in the local language and in English). This includes the address you are sending it to, your home institution address, dates of your fieldwork as well as any special labels, e.g. for fragile, cooled, frozen or hazardous goods.
- If you have several boxes you should consider numbering them. Remember to include the number in the packing list for each box.
- Make a list of everything in each package, including:
  - Type of equipment/samples
  - Total weight
  - Dimensions of the package
  - Value of contents
- Obtain all relevant import/export permits
- Include the content lists and relevant permits with the shipment, as necessary.

Make sure to keep copies of the lists and permits when travelling so that you can provide these to customs, the shipping company or station staff if needed.

Fragile equipment should be packed and transported in appropriate casing to ensure it is intact and ready for use in the field (Malin Johansson).

2.6 Checklists and equipment

2.6.1 Checklists

Check lists can be a useful tool, e.g. for:

- **Scientific equipment**: both what is available at the station and things you will need to bring with you.
- **Lab supplies and substances**: that you will need, e.g. sampling containers, gloves, and chemicals. It is also essential to note how chemicals will be transported, stored, and eventually disposed of.
- **Field camp equipment**: such as sleeping bags, sleeping mats, tents, cooking equipment, etc.
- **Compulsory and recommended safety equipment**: including communication equipment such as radios or satellite phones, bear deterrents, firearms, rubber or safety boots, helmets, life jackets, mosquito nets, etc. Depending on the station, some or all of the safety equipment may be provided by the station (see section 3.10). Contact the station staff if you want to bring your own equipment as approval may be required.
- **Personal equipment**: such as clothing, medication, etc. Clothing should keep you warm and protect you from wind and precipitation. It should also be breathable, easy to take on and off, small in volume, and lightweight. You may particularly want or need specific things once you are at the station, e.g. indoor shoes, power adaptors, etc.
- **Deadlines**: all the important deadlines, e.g. last dates to order equipment, last dates to send freight, last dates to obtain visas, etc.
- **List of contacts**: with all relevant telephone numbers and e-mail addresses for the station, your home institution, family, and other next of kin. Sometimes it is difficult to find such information in the field or at remote research stations with limited internet access. All members of your team should know where to find this information.
- **Sampling protocols**: You might think you know the sampling method well but when you are tired, cold or in a more extreme situation than usual it is easy to forget details. Make a cheat sheet covering all the steps in your sampling protocol. This has the added benefit of being a useful tool for teaching others on the expedition or later in your career.

It might be a good idea to laminate all the checklists that you are going to use in the field, e.g. your list of contacts, description of sampling methods, etc. This will ensure that all lists are waterproof and easy to clean. Appendix B provides examples of several equipment checklists.

It can be very useful to make comprehensive equipment and packing lists for everything you need to bring into and out of the field. This should include lists of scientific, personal and safety equipment (Morgan Seag).

Packing list

An example of a personal equipment list, including base layer, options for several insulating layers, and a wind- and waterproof outer layer:

Clothing and footwear:

- Underwear
- Thermal underwear (synthetic or woollen)
- Normal socks
- Wool socks
- Shirts and T-shirts
- Wool or light-weight fleece long-sleeve shirts (e.g. Polartec 100)
- Heavy-duty wool or fleece sweater (e.g. Polartec 200 or 300)
- Down or insulated synthetic jacket
- Wind and waterproof jacket (e.g. Goretex or equivalent material)
- Wind and waterproof trousers (e.g. Goretex or equivalent material)
- Hat, mittens, gloves – both liner gloves and thicker outer gloves (and ideally spares)
- Waterproof and warm hiking boots (make sure they are broken in)
- Gaiters
- Shoes for inside the station (e.g. slippers or clogs)
- Rubber boots, possibly with insulation

Miscellaneous:

- Sunscreen and lip protection
- Mosquito repellent and bug nets
- Hat with brim
- Sunglasses (ideally two pairs)
- Glasses/contact lenses if you wear them (and at least one extra pair of glasses and extra contact lenses)
- Backpack
- Personal water bottle
- Personal toiletries
- Personal medication, if required
- Power adaptor
- Pens and pencils
- Water resistant paper/notebook (e.g. Write in the Rain)
- Sleeping bag (if this is not provided by the station)
- Headlamp/torch with spare batteries
- Preparing a hard-drive with music and movies before going to the field for a long time can be a good idea. Remember to pack headphones.

2.6.2 Personal clothing

Outdoor clothing can be extremely costly, and you might need to buy some new equipment before going into the field. However, be aware that for most Arctic and Alpine summer fieldwork you may in fact not be exposed to temperatures that are very different from late autumn or early spring temperatures at more temperate latitudes. Keep this in mind before you spend all your savings on very expensive clothing. Good boots, a fleece or wool layer and a good waterproof shell jacket are normally enough to keep you warm and dry. These are the most important items of clothing to spend money on. You may also want to see what you can find in army surplus or charity stores. Sometimes they have good deals and you may find exactly what you are looking for.

Fieldwork clothing should keep you warm and dry, particularly in cold and wet weather (Jago Wallenschus).

HANDY TIP
If you wear glasses, make sure that you take at least one extra pair with you. Having an extra pair of sunglasses can be a very good idea, too.

In all cases, remember to bring spares of as many things as possible, particularly hats and gloves, since at most stations you will not be able to buy anything or easily get to a shop. Other useful items you should always have in your kit are a Leatherman or other multitool, duct tape, and cable ties; these always come in handy. It is also useful to have more than enough sampling containers and sample bags since there will always be additional things that you see in the field which you may want to take back with you.

2.7 Import and export regulations

2.7.1 Import and export permits

Not only might you need a visa or permits to visit the station but you will also very likely need permits for importing and exporting equipment and samples. Rules vary from country to country so we cannot list them all here. Make sure to find out what rules apply both when going into the country/region you will be visiting and when leaving and bringing samples back home. Colleagues or collaborators may be able to provide advice on who to contact for permits as can the station website or the station manager. Usually your university/ institute or a commercial shipping company can help with completing the necessary customs documents.

You will also very likely need permits if you are going to export physical samples (e.g. soil, rock, animal, plant or water samples). There may be strict limits on the number of samples you can take in and out of a country and you need to check with the relevant authorities to make sure that you have the proper documentation and permits. Also, keep in mind that in many countries it is illegal to export certain items, e.g. rocks or certain species, even if they are being sold locally (e.g. carved ivory from narwhale teeth or walrus tusks in Greenland, Denmark). Exporting threatened species is internationally regulated by CITES (www.cites.org). The CITES regulations are taken very seriously and you might end up with a big fine or even in jail if you bring parts of endangered wildlife with you. Also, remember that you have an ethical and moral responsibility to adhere to the relevant rules and regulations.
Be aware of all regulations in your home country and the country you are visiting to avoid having issues when returning home (and being disappointed about not being able to bring samples/gifts back).

2.7.2 Transporting hazardous goods

Hazardous substances (e.g. Lithium batteries, various chemicals, or radioactive materials) and weapons are often subject to special legislation and it is essential to identify and complete the correct paperwork well in advance. There are some handy resources at the end of this chapter with further information regarding these materials.

It is often a good idea to use a commercial shipping company for sending hazardous materials across borders. They will give you support in handling all related paperwork.
A shipping company will much more easily be able to produce the correct papers based on a content list and a recipient address provided by you. Shipping is an extremely competitive business, so prices on having paperwork done are normally reasonable and marginal in relation to the value of the equipment you are sending and to the value of having your cargo arrived safely and on time.

Transporting hazardous substances

Hazardous materials must be marked in accordance with the applicable regulations. Note that there are international regulations regarding transport of such materials by land, air, and boat. There may also be additional national laws in your home country or the country that you will be visiting. Make sure that you comply with all applicable regulations in each of the countries through which your freight (and you) will be travelling.

Note that there are often less stringent rules regarding hazardous substances that are transported by ship, so you may want to take this into consideration when arranging your equipment transport.

Some common hazardous cargo items include (note this is by no means a complete list):

- Acid batteries/car batteries
- Lithium batteries
- Aerosol spray cans (e.g. WD-40, paint)
- Chemicals (e.g. Isopropyl alcohol, acids, bases or buffers for laboratory work)
- Various fuels (e.g. white gas, kerosene, propane, etc.)
- Fuel bottles/containers, even empty ones
- Explosives and detonators
- Generators
- Boat engines
- Snowmobiles
- Pressurized gas cylinders (nitrogen, oxygen, helium, etc.)
- Fire extinguishers

2.7.3 Handling cooled and frozen materials

Keeping your samples cold or frozen during storage and transport can be a challenging part of any fieldwork. Depending on what type of samples you aim to collect we recommend you first explore what cold storage facilities are available at the station, including at what temperatures and what capacity exists. It is important to inform the station manager in advance that you will require cooling space.

Sometimes samples will need to stay in the field until the end of the season before being transported back (e.g. in a -80 °C freezer being shipped back from the station). Make sure you know who is responsible for sending your samples and make sure to check that they know exactly how many of your samples are to be sent by when and to where. With many field teams at a station over the season, freezers can often become very messy. It is essential to keep track of how many samples you had of what kind, to make sure that they are labelled appropriately and are stored as organised as possible. It can be a good idea to decide in advance about having some kind of special packaging to keep all your samples together in the freezer. This could, for example, be a sealed plastic box with your name, the date of storage, and other relevant information written clearly on the outside.

When transporting your cooled or frozen samples home, it is essential to avoid interruptions to the cooling; warming or thawing may leave your samples unusable. For shorter periods, camping-style cooler boxes and thermal packs may be an option. For longer periods, styropor boxes or dry-shippers filled with dry ice or liquid nitrogen are common practice. They are relatively easy to transport, even on airplanes (however, with special regulations for dry-shippers). When using dry-shippers, ensure the samples sit in the middle, that the container is properly sealed and that there is a "keep upright" label on the outside. More information about cold chain logistics are included in the chapter resources.

2.8 Insurance

You and possibly also your equipment will need to be insured for going into the field. It is therefore important to make sure that you have the required travel and health insurance before leaving. Find out from your workplace what kind of insurance they might already have and whether you will need to obtain additional insurance for either yourself or your equipment. Depending on where the station is located you may also need to have additional Search and Rescue (SAR) insurance to cover the costs of any rescue missions in polar latitudes or high altitudes. The station website should have information about insurance requirements, which may include coverage for both SAR and evacuation.

2.9 Medical check-ups and chronical illness

You may need to undergo a medical examination before being allowed to go into the field; as required by the station or your institute. This may include blood tests, fitness tests, and/or a dental check-up, amongst many other things. You may also be required to have vaccinations against certain diseases such as measles, meningitis, tetanus, rabies or hepatitis. Check with the station (website or manager) and your university/institute what their requirements are for the region you will be visiting. You may also be required to submit medical records to the station manager if you are going to a very remote area for a lengthier amount of time. These records may also need to be translated into English (or another relevant language). Obviously, the station must ensure these records are kept confidential. In most countries it is illegal not to have a high level of confidentiality and data security relating to personal health information.

If you suffer from any serious chronic or reoccurring illness, it is important that the station management and your team leader (if not the whole team) are made aware of this. While it should not normally restrict your fieldwork, it is good that other team members and the station staff know about any specific symptoms, where your medicine is, and how to use it (e.g. in case of strong allergic reactions, asthma or diabetes). If you need any special medicine, make sure that you have it with you at all times and that at least your team leader (or another team member) is aware of what you are taking, why, typical symptoms, and where you keep your medicine. Make sure to store all medicine at the correct temperature as some don't tolerate being frozen.

Pregnancy is not a medical issue as such but your own pregnancy or the expected delivery date of your spouse close to your field season may hamper your physical and mental abilities to focus on working in a remote environment. Due to potential health complications, you should seek to avoid doing fieldwork at remote research station when you are pregnant. Note also that airline companies have regulations related to pregnancies and flights. Being young parents and going on fieldwork to a remote location for a longer period of time also deserves some thoughts about how to keep in touch with your family at home.

2.10 Training activities

You and everyone in your team will usually be required to carry out a first aid training prior to going to the field. Find out what other specific safety training needs to be completed before going to the field and what training can be arranged at the station. Chapter 3 provides a detailed introduction to safety considerations in the field, including training.

Some stations work with nearby educational facilities that provide training, for example, in first aid, navigation skills, behaviour in bear country, handling firearms, snowmobile driving or sea survival training. Find out whether you can do training with these organisations or whether you are required to do it before going into the field. Keep in mind that training related to reading terrain and snow conditions, as well as avalanche and glacier rescue, may need to be organised well in advance due to their seasonal nature.

Plan necessary training activities at your home institution, appropriate training facilities, or at the station. A field party is training crevasse rescue skills before starting their fieldwork near Ny Ålesund, Svalbard, Norway (Simon Escalles).

HANDY TIP

Training together with your team is a fun way to get to know each other and helps to build good team spirit. The same goes for practicing sampling protocols, equipment testing, and instrumentation set-ups.

HANDY TIP

It is important that several team members have similar skills so that members can replace one another in case of an emergency. For example, you do not want only one person with first aid training. If that person gets injured, there needs to be someone else with similar training who can step in and help.

2.11 Financial and other administrative issues

If you are going into the field for several weeks or even months make sure to put all your financial and administrative affairs in order well in advance. To avoid unnecessary hassle when you return home make sure that all bills and taxes are paid or that someone takes care of it on your behalf. If needed, inform your bank that you will be travelling so that they do not unnecessarily block your account or credit cards. You may also need to inform your insurance providers that you will be away. Depending on how long you go into the field, you may want to consider asking the post office to put a hold on your mail delivery and giving someone Power of Attorney so that they can act on your behalf for all administrative affairs.

HANDY TIP
Provide e-mail and phone numbers for the station and any other relevant information such as travel dates to those staying at home. This is very useful should they need to contact you in an emergency.

If there is an election taking place while you are away, make sure to arrange that you vote in advance. For voting in general assemblies of NGOs or similar, it is sometimes possible to give permission for someone else to vote on your behalf.

2.12 Final checks before leaving

It is useful to have a final checklist prepared to ensure that you have done everything necessary before leaving. An example of such a checklist could be:

- Have you obtained all permits and visas required?
- Is your passport valid and does it meet all visa requirements (e.g. your passport might need to be valid for at least six months from the end-date of your trip)?
- Have you delivered all cargo for shipping and is the correct accompanying documentation provided?
- Have you completed all necessary medical checks and all relevant safety training?
- Are your financial and administrative affairs properly arranged?
- Do you have all relevant contact details of the station, next of kin information, emergency contacts, etc.?
- Are subscriptions for satellite communication systems in place and valid?
- Do those staying at home know how to contact you? Are they aware of the communication possibilities while you are in the field?
- Do you have all necessary tickets and hotel reservations, and have you arranged travel to the airport/port?
- Do you have enough money and personal gear with you for your trip to the station?

CHAPTER RESOURCES

Resources related to health and vaccinations:

- The French Institut Pasteur has a great tool to know what vaccinations are needed for travel to certain areas:
  www.pasteur.fr/en/medical-center/preparing-to-travel-abroad
- An example of a medical examination form for fieldwork:
  https://neem.dk/documentation/pdfs/Med.2009.pdf
- Medical guidelines from the British Antarctic Survey (also valid for fieldwork in the Arctic):
  www.bas.ac.uk/for-staff/polar-predeployment-prep/intro-guidelines-and-forms/medical-guidelines-and-forms

Resources related to equipment:

- A packing list from the Zackenberg Ecological Research Station:
  http://zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/pdf/PackingList.pdf
- An example of clothing and personal items checklists from Toolik Research Station:
  https://toolik.alaska.edu/user_guide/what_to_bring.php
- INTERACT pocket guide on using drones that was developed during the INTERACT Drone Workshop on Svalbard, Norway:
  https://eu-interact.org/app/uploads/2017/11/interactfolderdigital.pdf

Resources related to hazardous goods:

- European Union transport regulations:
  https://ec.europa.eu/transport/road_safety/topics/dangerous_goods_en
- Information from the International Air Transport Association (IATA):
  www.iata.org/whatwedo/cargo/dgr/Pages/index.aspx and
  https://www.iata.org/whatwedo/cargo/dgr/Pages/dgr-guidance.aspx
- Detailed information about transporting hazardous material via ship can be found in the International Maritime Dangerous Goods Code:
  www.imdgsupport.com
- University of Manitoba, A quick guide to bringing hazardous substances into the field:
  https://asp-net.org/sites/default/files/website_files/2016_ASP_Quick%20guide%20for%20Dangerous%20goods.pdf

Resources related to cold chain logistics:

- Background on cold chain logistics with information on various cooling agents and refrigerated containers used for transport of cooled materials: https://transportgeography.org/?page_id=6585
- World Health Organization (WHO) guide for shipping with refrigerated liquid nitrogen: https://www.who.int/ihr/biosafety/faq_infectious_subst_shipping.pdf
- Guidelines for Transporting Environmental Samples under Cryogenic Conditions from the German Environmental Specimen Bank with information on different cryogenic conditions, safety instructions, required material, equipment, and preparations: https://www.umweltprobenbank.de/upb_static/fck/download/SOP_Transport_EN.pdf
- Quick, a global medical dryshipper rental company: http://healthcare.quick.aero/medical-transportation/dry-shipper-rental
- Regulations of the Federal Aviation Administration on the transport of dryshippers: https://www.faa.gov/about/initiatives/hazmat_safety/more_info/?hazmat=55
- DHL service for temperature controlled shipments: http://www.dhl.com/en/logistics/temperature_controlled_logistics.html
- Fedex cold chain service: http://www.fedex.com/pt_english/shipping-services/industry-solutions/supplychain/coldchain.html and frizzo@fedex.com

Resources related to import/export regulations:

- Import/export information for the European Union (Denmark/Greenland/Faroe Islands, Sweden, Finland): http://ec.europa.eu/trade/import-and-export-rules
- Information regarding importing biological goods into the UK: www.bas.ac.uk/for-staff/polar-predeployment-prep/intro-guidelines-and-forms/importing-biological-samples-into-the-uk
- Import/export information for Norway: www.toll.no/en/corporate/import/import-guide-for-beginners and www.toll.no/en/corporate/export/export-guide-for-beginners
- Import/Export information for Sweden: https://www.tullverket.se/4.7df61c5915510cfe9e75958.html
- Import/export information for Canada: www.international.gc.ca/controls-controles/index.aspx?lang=eng
- Import/export information for Russia: http://eng.customs.ru
- Import/export information for the USA: www.usa.gov/import-export

Resources related to specific jurisdictional resources for the arctic countries

Disclaimer: The resources in this chapter are compiled to the best of our knowledge. Please note that, although all care is taken to have current information in this guide, information for fieldwork planning in different countries may be incomplete and procedures and contact information can be updated or changed without notice. Thus, we encourage you to always look for the latest information to ensure your fieldwork and data collection are successful.

You can also find relevant information about local legislation of relevance to scientists on the websites of the stations that you want to visit.

Alaska, USA:

- The International Arctic Research Centre (IARC) supports arctic operations and lists some information and relevant web links for safety in the field:
  https://uaf-iarc.org/about-iarc/for-iarc-employees/field-safety/
- Land-use authorisations must be obtained through the University of Alaska Facilities and Land Management Office any time a research project is conducted and/or when crossing property not owned by the University of Alaska. Instructions and guidelines for researchers requesting access to private or state-owned property can be obtained from the University of Alaska Facilities and Land Management Office:
  http://www.ualand.com/index.cfm?fuseaction=Processes.Process&pid=10000
- Import/export information for the USA can be found at:
  www.usa.gov/import-export

Canada:

- For fieldwork in Canada, be aware that permitting and licensing are covered by territorial, federal, and land claim legislation, all of which vary by location. In addition, you will need special permits for working in national parks, protected areas, for nearshore/marine scientific research, and agreements with First Nations to carry out your fieldwork. The Canadian government provides guidelines about research permits, licenses, and heritage area specific information for the different protected areas, and guides your application:
  https://www.pc.gc.ca/apps/rps/page1_e.asp
- A guide for scientific research licences and permits, land claim regions, and community contacts for the Northwest Territories can be found here:
  https://nwtresearch.com/sites/default/files/doing-research-in-the-northwest-territories.pdf
  In addition, the Aurora Research Institute provides additional information on research licensing:
  http://nwtresearch.com/licensing-research
- If you plan to conduct field research in Nunavut you will require a licence, permit, or other authorization to do so. Research in the physical/natural, social, and health sciences is licensed by the Nunavut Research Institute in accordance with Nunavut's Scientists Act. Before applying for a permit, please contact the Manager of Research Liaison, Mosha Cote (mosha.cote@arcticcollege.ca) to determine whether your research project meets the requirements for licensing under the Scientists Act, or whether your study can be licensed under another legislation. More information can be found here:
  https://www.nri.nu.ca/research-licensing-applications

- A guidebook on scientific research in the Yukon has been published by the Yukon government:
  http://www.tc.gov.yk.ca/publications/Guidebook_on_Scientific_Research_2013.pdf
  In addition, the Department of Tourism and Culture of the Yukon Government provides information on research licensing and contacts:
  http://www.tc.gov.yk.ca/scientists_explorers.html
- For Newfoundland and Labrador, guidelines for scientific research, obtaining permits, and an annual list of research projects are summarised here:
  https://www.tcii.gov.nl.ca/parks/sr.html
  In addition, the Nunavut Research Institute provides additional information on research licensing:
  https://www.nri.nu.ca/
- Import/export information for Canada:
  www.international.gc.ca/controls-controles/index.aspx?lang=eng

Information about research relationships and working with First Nations in Canada can be found among the following websites:

- Negotiating Research Relationships with Inuit Communities: A Guide For Researchers (Inuit Tapiriit Kanatami):
  https://itk.ca/negotiating-research-relationships-guide
- Guidelines for Research Involving Inuit (Inuit Tapiriit Kanatami):
  https://ruor.uottawa.ca/bitstream/10393/30411/1/2010_Ethics_FactSheet9.pdf
- Ethics in First Nations Research (Assembly of First Nations):
  https://www.afn.ca/uploads/files/rp-research_ethics_final.pdf
- Ownership, Control, Access, Possession Principles (First Nations Information Governance Centre):
  http://fnigc.ca/ocap.html
- Principles of Ethical Métis Research (Métis Centre, National Aboriginal Health Organization):
  https://ruor.uottawa.ca/bitstream/10393/30555/1/2011_04_ethics.pdf
- Nunatsiavut Government Research Process (Nain Research Centre):
  http://www.nainresearchcentre.com/research-process/
- Guidelines for Community Engagement with NunatuKavut (NunatuKavut Community Council):
  http://www.nunatukavut.ca/home/files/pg/guide_for_researchers.pdf
- Northwest Territories Scientific Research Licence (Aurora Research Institute):
  http://nwtresearch.com/licensing-research/scientific-research-license
- Yukon Scientists and Explorers Licence (Yukon Government):
  http://www.tc.gov.yk.ca/scientists_explorers.html

Finland:

- In Finland, people of all nationalities have the right to roam freely in the countryside under the traditional legal concept known as "Jokamiehen oikeudet" or "Everyman's Right". The Ministry of the Environment has a booklet about the rules and responsibilities included in the "Everyman's Right": http://www.ym.fi/en-US/Latest_news/Publications/Brochures/Everymans_right
- Special permission is needed from the Finnish Border Guard for activity in the Finnish-Russian border zone:
  https://www.raja.fi/guidelines/border_zone
- Permits related to work with protected animals and plants or habitat protection must be applied for from Centres for Economic Development, Transport and the Environment. For protected species you need a permit for sampling and handling live or dead specimen or parts of them. When needed, import and export permits can be obtained from the same centre as well. More information can be found at: https://www.ymparisto.fi/en-US/Forms_permits_and_environmental_impact_assessment/Permits_notifications_and_registration
- In Finland, unprotected vascular plants in the field layer (herbs and grasses) as well as most invertebrates can be collected without permission from the landowner due (this is part of the "Everyman's Right" (applies only outside of protected areas)). However, you will need permission from the landowner to take soil samples or to collect samples from trees, mosses, and lichens. Especially in northern Finland most of the wilderness is state-owned land. In these areas Metsähallitus (the state landownship authority) is the authority that provides all permits. They are also the authority that provides permits for research work carried out in protected areas. You will also need a permit from the landowner should you need to use any motor vehicle off road (including snowmobiles). Metsähallitus provides these permits on state-owned land. The link to their research permit information page can be found here:
  http://www.metsa.fi/web/en/permits-for-research-and-photography
  We recommend applying for these permits several months in advance. Some authority decisions have a 30-day complaint period, which means that the permits come into effect only 30 days after the authority has given its decision.

Greenland and Faroe Islands, Denmark:

- Visa: Greenland and the Faroe Islands are part of the Kingdom of Denmark. Different rules concerning visas apply for travellers to Greenland and the Faroe Islands depending on their home country, i.e. for Nordic citizens, EU citizens, and non-EU citizens. Note that a visa to Denmark is not valid for Greenland and the Faroe Island unless this is stipulated on the visa. To identify visa needs for your country to Greenland see:
  https://naalakkersuisut.gl/en/Naalakkersuisut/Departments/Udenrigsanliggende/Rejser-til-og-fra-Groenland/Rejse-til-og-ophold-i-Groenland
  to Faroe Island see here:
  https://www.government.fo/en/foreign-relations/missions-of-the-faroe-islands-abroad/the-representation-of-the-faroes-in-london/travel-visas/
  or contact your nearest Danish embassy/consulate or arrange visas with a travel agency.
- Greenland – Science and sample export permits: When doing research in Greenland you will need a permission to handle wildlife, or collect and export scientific samples. Different rules apply for 'Biological and genetic resources', 'Minerals', 'Archaeological artefacts, meteorites and fossils', and 'Mammals, birds and fish'. Export of endangered (CITES listed) species require a specific permit and work in protected areas may also require a specific permit. The legislation is administered by the Greenland Government and most links can be found here:
  https://exp.gl/Legislation--Logistics/Links

- Greenland – Special areas: Special rules apply if you are going to work in so-called 'remote parts of Greenland' and if you are going to work in 'The National Park of North and Northeast Greenland'. Jurisdictional resources, including relevant application procedures and forms, are available on the website 'Travel activities in remote parts of Greenland':
  https://exp.gl/
  Please note that you can also find information concerning legislation relevant for fieldwork outside 'the remote parts of Greenland' on this website. For work in 'remote parts of Greenland' you will need a Search and Rescue insurance. Self-insurance is accepted for employees from Danish and Greenland institutions, but only after having submitted a guarantee form to the Greenland Government. Zackenberg Research Station, Villum Research Station, East Grip, and Summit are all located in 'remote parts of Greenland' and in 'The National Park of North and Northeast Greenland'. Sermilik Station, Arctic Station, DMI Geophysical Observatory Qaanaaq and the Greenland Institute of Natural Resources are not.
- Faroe Islands: For research in the Faroe Islands see:
  https://www.government.fo/en/the-government/ministries/ministry-of-education-research-and-culture/

Iceland:

- The Icelandic Nature Conservation Act regulates outdoor activities and standards of conduct. It stipulates that everyone has the right to travel around the country as long as the traveller is tidy and careful not to damage or otherwise spoil natural resources. It is allowed to cross uncultivated private property without seeking any special permission, but landowners may limit routes with signs and other marks. State-owned land such as conservation areas and forestry areas are open to everyone with few exceptions. These exceptions include – but are not limited to – access during breeding seasons or during sensitive growth periods. More information on public rights in the nature can be found here:
  https://www.ust.is/the-environment-agency-of-iceland/tourist-information/notes-for-visitors/
- In Iceland, the Ministry for the Environment and Natural Resources
  https://www.government.is/topics/environment-climate-and-nature-protection/
  oversees the country's Environmental Agency, Meteorological Office, Forest Service, Soil Conservation Service, and the Icelandic Institute of Natural History. It provides a useful overview about these and other institutes, and information on the relevant policies can be found on the websites of the respective institutions (see below).
- The Icelandic Institute of Natural History (IINH)
  http://en.ni.is/index.html
  conducts basic research on the zoology, botany, and geology of Iceland. IINK houses libraries, collections, handles research, and monitors various projects in Iceland. The institute also provides consulting services as well as information on permissions for fieldwork and exporting samples:
  http://en.ni.is/aboutus/consultingandservices/index.html
- The Environmental Agency of Iceland
  https://www.ust.is/the-environment-agency-of-iceland/
  promotes the protection as well as sustainable use of Iceland's natural resources. It also offers information on protected areas, handling fuels, chemicals, toxic and hazardous substances, driving in uninhabited areas, and waste management.
- Depending on the type of research and fieldwork you will be doing, you might also have to contact and get a permit from the Icelandic Food and Veterinary Authority
  http://www.mast.is/english/frontpage/about-mast/
  or the Cultural Heritage Agency of Iceland
  http://en.minjastofnun.is

Mainland Norway:

- In Norway, you have the right to roam freely in forests and open country, along rivers, on lakes, and in the mountains irrespective of who owns the land. The main principles of the "right to roam" are legally enshrined in the Outdoor Recreation Act of 1957. General information about its limits can be found on the website of the Norwegian Environmental Agency:
  https://www.miljodirektoratet.no/globalassets/publikasjoner/m86/m86.pdf
- In Norway one needs to obtain permission from the local authorities and landowners before carrying out any interventions in the natural landscape, such as setting up fences or installing equipment that are highly visible. To collect protected species (including all vertebrate species), permission must be obtained from the Norwegian Environment Agency (Miljødirektoratet). Interventions or experiments causing stress or pain to vertebrates must be approved by national authorities. The website of the Finse Research Station hosts a collection of useful information, web links, and contacts:
  https://www.finse.uio.no/user-information/rules-and-regulations/permits/
- All vertebrates in Norway are in principle protected, and a number of plant species and invertebrates are also protected by law (in Norwegian):
  https://lovdata.no/dokument/SF/forskrift/2001-12-21-1525
  You must obtain permission from the Norwegian Environment Agency (Miljødirektoratet) to trap, kill, or collect any such species. Applications should be sent to: Norwegian Environment Agency, Pb. 5672 Sluppen, 7485 Trondheim.
- Whole specimens or biological material that are legally collected can be brought out of the country with no further permissions as long as the species are not listed as part of the CITES convention
  https://www.cites.org/
  Note, however, that most countries have restrictions on the import of biological material. Norwegian authorities may assist in obtaining any documentation needed for import.

Svalbard, Norway:

- Svalbard is part of the Kingdom of Norway but is not part of the Schengen area. This means that to visit Svalbard a visa may be required. Most flights to Svalbard depart from either Oslo or Tromsø, which may mean you also need to consider whether you need a visa for mainland Norway as well. Contact your nearest embassy, consulate, or travel agency for more information.
- The Svalbard Science Forum
  https://www.forskningsradet.no/prognett-ssf/About_us/1253969737314
  provides information about infrastructure and activities as well as an overview about legislation, research permissions, and regulations for fieldwork in Svalbard:
  https://www.forskningsradet.no/prognett-ssf/Home_page/1253969737234
- Hundreds of researchers from approximately 30 nations run research and monitoring programs in Svalbard every year. Close to 3,000 projects are registered in the Research in Svalbard (RiS) database so far
  https://www.researchinsvalbard.no/

- The portal is a valuable tool for coordination and cooperation for those carrying out research, fieldwork, and monitoring in Svalbard. Registered projects will be assigned a unique RiS-ID number, which must be obtained before you can apply for a permit from the Governor of Svalbard, book flights to and accommodation in Ny-Ålesund, or do research at the Stanisław Siedlecki Polar Station in Hornsund. You must register all research projects requiring permission pursuant to the Svalbard Environmental Protection Act; or projects which will be carried out in Ny-Ålesund or Hornsund, as applications and bookings are not accepted if they come from outside the portal. Svalbard-related research projects receiving funding from the Research Council of Norway or the Svalbard Environmental Protection Fund are also required to register via RiS. All other research projects with a connection to Svalbard are highly encouraged to register their projects, including projects in the surrounding Svalbard waters.
- Svalbard-specific Norwegian legislation, notably the Svalbard Environmental Protection Act https://www.regjeringen.no/en/dokumenter/svalbard-environmental-protection-act/id173945/ is highly relevant to all field research in the archipelago. More often than not, field research will require an exemption from the environmental regulations and/or a permit from the Governor of Svalbard. With some exceptions, general Norwegian legislation also applies to the entire Svalbard region and regulates a number of research-relevant activities, including the use of radio frequencies, manned and unmanned aircraft operations, the processing of personal data, installations that may affect maritime safety and navigation, the handling of sources of radiation, marine scientific research, animal experiments, the use of airborne photo/video sensors, the ringing of birds, the launching of objects into space, and working arrangements. Find out more about legislation and permits: https://www.forskningsradet.no/prognett-ssf/Research_permissions/1254013737002
- Challenges to fieldwork on Svalbard include polar bears, unstable sea-ice, glacier crevasses, avalanche, drifting icebergs, extreme weather and climate, poor communications coverage and scarce infrastructure. The Governor of Svalbard https://www.sysselmannen.no/en/ updates different guides and field logs on its websites that can be helpful in your fieldwork planning, as well as guidelines for scientists on Svalbard https://www.sysselmannen.no/en/Scientists/Guide-for-scientists-on-Svalbard/
- The University Center in Svalbard (UNIS) offers safety courses which address Arctic- and Svalbard-relevant risks and challenges. Contact UNIS for further information https://www.unis.no/ You can find general safety instructions from UNIS here: https://www.unis.no/resources/hse/
- General import/export information for Norway can be found at: www.toll.no/en/corporate/import/import-guide-for-beginners and www.toll.no/en/corporate/export/export-guide-for-beginners
- A reliable logistics company on Svalbard is PolePosition: https://www.pole-position.no/

Russia:

- Preparing for fieldwork in Russia can be relatively complex. We recommend having someone with knowledge of Russian language (either yourself or another team member) help with the organisation and ideally also a Russian project partner. Having a local partner can be extremely helpful in terms of the organisation and planning.
- All foreign nationals are required to have entry and exit visas to travel to the Russian Federation. More information on the different types of visas and required documents can be found here: http://www.russianembassy.net/rusvisa.html
  Make sure to contact your nearest Russian embassy/consulate or to arrange visas through a travel agency. Note that you may need an invitation letter from a host scientist or institute based in Russia. Be aware that the application process can take several months, although sometimes visas can be obtained more quickly at a higher cost.
- Shipping field equipment and customs: you will be required to complete a Russian Customs freight declaration for every item that you import or export into/out of Russia. All Customs import declarations can be submitted electronically. The website of Russia's Federal Customs Service contains the link to the portal for electronic declarations:
  http://eng.customs.ru/
- For shipping equipment, or taking it with you as your luggage, have very detailed packing lists, and avoid foreign newspapers as cushioning as they may cause problems. When travelling with your equipment and/or cash in your luggage, spread it among all team members.
- Be careful with maps, GPS devices, and printed or digital satellite imagery of any resolution, particularly near national borders and along the Arctic coastline. It is a good idea to keep them in a folder and not have them openly visible in your camp or on yourself.
- When travelling, make multiple backups of your laptop hard drive, particularly your collected data after the end of your fieldwork. Transport your backups separately from the laptop. Chances are that customs may "investigate" your laptop and return it in "factory condition" (with all your data wiped off).
- When doing research in Russia you will need a permission to take scientific samples and to export scientific material, and perhaps even to visit your field site. Different rules apply for water samples, sand/soil, and rocks, respectively. Sand and water samples are relatively easy to handle, animal or fossil samples are not. In contrast, soil and rock samples taken by foreign researchers can be misconstrued as a search for resources and are thus more challenging to export. We recommend that you always have the proper documentation for any import/export into/out of Russia.
- The Arctic and Antarctic Research Institute (AARI) is the oldest and largest Russian research institution in the field of Polar research. AARI has comprehensive scientific, technical, and informational resources as well as highly-skilled scientific staff. The institute is involved in planning, coordinating, and providing complex scientific services in the Arctic and Antarctic using research vessels, aircraft, polar stations, etc. More information about the institute and how to make contact can be found at:
  http://www.aari.ru/index_en.html

- Using drones: According to Russia's national aviation authority, the State Civil Aviation Authority of Russia https://www.aviaru.net/english/join/faar.shtml
  flying a drone is legal in Russia but we recommend being aware of and being compliant with the drone regulations listed here:
  https://uavcoach.com/drone-laws-in-russia/
  To obtain a flight permit, you must submit an application to the local office of Air Traffic Management. For the application you will need to provide your personal information and details about the flight and the drone. Learn more about where and how to submit the application through this website (in Russian):
  https://www.favt.ru/poryadok-ispolzovaniya-bespilotnyh-vozdychnih-sudov/

Sweden:

- "Allemansrätten", the Right of Public Access, is granted by the Swedish constitution and gives you free access to all outdoor regions. However, with this right comes responsibilities – to take care of nature and wildlife and to show consideration for landowners and other people enjoying the countryside. The Swedish Environmental Protection Agency sums up the Right of Public Access in the phrase 'Don't disturb – Don't destroy.' More detailed information is summarised here:
  https://visitsweden.com/about-the-right-of-public-access/
  and here:
  http://www.swedishepa.se/Environmental-objectives-and-cooperation/Swedish-environmental-work/Work-areas/This-is-the-Right-of-Public-Access/
- To take scientific samples in Sweden permits are usually required. The permitting body in the north of Sweden is the environmental protection department of the Regional county board of Norrbotten
  https://www.lansstyrelsen.se/norrbotten/stat-och-kommun/natur/tillstand-och-dispenser-i-skyddad-natur.html
  e-mail: norrbotten@lansstyrelsen.se
  There is no need for any general registration of a project. As you will need a permit, the project will be registered there. If the sampling is to take place at a research station then the station may have a general permit. What regulations apply to a given project will depend on what you want to sample and where.
- In some areas, the local Sami village may need to review any project/permit. The permitting process can take quite some time, so it's important to contact the regional county board and/or research station well in advance of the planned fieldwork.
- The Swedish Polar Research Secretariat is a government agency that promotes and co-ordinates Swedish polar research. This includes following and planning research and development, as well as organising and leading research expeditions to the Arctic and Antarctic. An overview about the networks and cooperations conducting scientific work in Sweden as well as about the Abisko Research Station is provided here:
  https://polar.se/en/research-in-abisko/networks-and-co-operations/
- For exporting samples, we recommend contacting the Swedish Customs agency:
  https://www.tullverket.se/4.7df61c5915510cfe9e75958.html

Key considerations

- It is crucial to consider all relevant health and safety aspects, safety training, best-practice decision-making, and good leadership for a successful field season.
- Pay close attention to all safety protocols during transport to the station as well as travel to and from field sites.
- Familiarise yourself with risks and procedures at the station, in workshops and in laboratories.
- Carefully think through where to set up your field camp and all camp routines, such as cooking and polar bear protection if needed.
- Study specific natural hazards in your fieldwork area and season and learn how to adapt your work to stay safe in challenging terrain. This includes wildlife, parasites, and other dangers such as weather changes. A thorough risk assessment (see section 1.5) will help you to take the right measures.
- Find out what communication, navigation, and safety equipment you will need. Check what is available at the station and what you need to bring with you.
- Make sure you have adequate personal clothing and equipment to keep warm and dry at all times (remember layering).
- Always have a list of emergency contact details with you and make sure that everyone in your team knows where to find it.

3 Safety

Svalbard (Jon Aars)

Staying safe in the Arctic and in northern Alpine regions means being well prepared, well trained, and following all the relevant safety protocols. The safety of yourself and your team should be of highest priority during Arctic and Alpine fieldwork. Because of its importance, this entire chapter is dedicated to this subject. However, it is not intended to replace the more complete theoretical or hands-on training that relevant safety courses will provide, or the guidelines developed by the INTERACT individual stations. It is strongly recommended that you find out what safety courses are available and required and that you complete these before leaving for the field. The resources section at the end of this chapter provides a good starting point to find out what courses are available (there is a huge variety).

Safety should always be your top priority when you are out in the field (Magnus Andersen).

3.1 General safety guidelines

There are some general safety guidelines that apply to any kind of activity in the Arctic and northern Alpine regions.

Preparing your field trip:

- Be properly trained for the tasks you set out to do.
- Ensure that all team members have completed first aid training.
- Always prepare thoroughly, i.e. check the weather forecast before leaving, select clothing and safety equipment that is appropriate for the activity being conducted, and listen to the advice of people with local and/or specialist knowledge.
- Always wear or bring warm and waterproof clothing with you.
- Always bring relevant means for navigating.
- Always bring at least two independent means of communication. Furthermore, bring a personal locator beacon (PLB) or an InReach/SPOT if you are operating beyond inhabited areas/areas with no cell phone coverage.
- Always bring general and activity-specific safety equipment and check that your equipment is in good working condition.
- Know how to use the equipment that you have.
- Be aware of potential risks and how to prevent these.
- Always have relevant emergency contact details with you and make sure that everyone knows where to find them.
- Always inform people of where you intend to go and when you intend to return.

In the field:

- Never head into the wilderness alone.
- Be present and pay attention to where you are and what is happening around you.
- Pay attention to changes in weather, terrain, snow, and ice conditions.
- Regularly check in with each other (e.g. for frostbite, level of exhaustion, need for breaks).
- Remember to eat, drink, and rest enough. Exhaustion can lead to unsound judgement, unnecessary risks, and accidents. It is important to keep a good balance between work and rest.
- Remember to make all routine calls (e.g. with the station, sub-groups, etc.).
- Do not be afraid to point out any safety issues, however minor they might be.

Keep in mind that each INTERACT station likely has different safety protocols and it is essential you inform yourself about them when preparing for fieldwork at home and upon arrival at the station.

3.2 Safety barriers

Various safety barriers exist, including knowledge level, attitude, experience, culture, equipment, skills, judgement, and leadership. All of these are covered to some extent in this chapter. However, it is essential that you spend some time reflecting on all of these aspects – both as an individual, but perhaps more importantly also with the field team that you will be part of.

A good way of orienting your team towards a forthcoming task or operation is "toolbox meetings" where you can briefly discuss the best practice and make sure that everyone knows what to do (Andrea Schneider).

HANDY TIP
A good way of orienting your team towards a certain task or operation, for example crossing a frozen fjord with snowmobiles, mapping and sampling in steep terrain, or starting to move on a glacier, are "toolbox meetings". The purpose of these short meetings is to ensure that everyone involved is aware of their role and responsibility as well as the individual risks involved. Find a place, preferably with a good view of the surrounding terrain, provide an overview of the upcoming activity and what to do in case something unforeseen happens.

HANDY TIP
Another strategy can be a "Stop work" philosophy in case an activity or situation appears unsafe. Stop working, evaluate the situation, and rearrange/remove the risk before continuing. It is important to point out that anyone should be encouraged to speak up about safety issues and all concerns should be addressed appropriately.

3.2.1 Knowledge, experience, and skills

If you are going to be doing fieldwork in the Arctic or northern Alpine regions, you quite obviously will need particular knowledge and skills. Depending on where you go and what fieldwork you will be doing, this may vary from knowing how to cross a glacier safely to setting up a field camp in bear country. Be honest with yourself and your field team about your skills and knowledge level. Overestimating your abilities may put not just you but the entire team in danger.

Experience also plays an important role in being able to identify risks and potential incidents early. While you may not have any experience doing fieldwork, the safety of your team relies on all team members being aware, insightful, and resourceful at all times. Recognise that sometimes even the most seasoned scientists make mistakes, so do not hesitate to speak up should you perceive a risk or an issue.

Scientists from Norwegian Polar Institute and Paul Scherrer Institut in Switzerland work together to establish their field camp at Lomonosovfonna, Svalbard, Norway (Gerit Rotschky).

3.2.2 Attitude and culture

Having an open attitude and willingness to learn and communicate in your team is possibly equally as important as having the right set of skills to do fieldwork in the Arctic and northern Alpine regions. Each team will be different but it is essential that each member feels able to communicate openly, particularly concerning safety. Cultures differ, but it is important that you do not let this get in the way of safety. For example, hierarchy might be stronger in some cultures, but this does not mean that one should not be able to point out safety issues regardless of how minor they might be.

3.2.3 Judgement and leadership

In an emergency situation, strong leadership and good judgement and decision making is essential. One person, or a small team of people, needs to take responsibility for making decisions should a situation arise (see also section 3.11). Ideally, this should be decided in advance of anything occurring, so it is wise to discuss with your team who will take responsibility in which situation - this may differ depending on the situation. Obviously, the number one priority of field safety is avoiding them in the first place but incidents may arise or deteriorate because of misunderstandings, miscommunication or poor leadership.

3.2.4 Trip plan

Lack of knowledge in the team on what needs to be done where and when is also a safety barrier. Similar to your schedule for the entire field period, it is therefore also useful to make a trip plan for single or multi-day outings. This includes a precise plan on where, when, how, and how many people will be going, what work will be performed, what equipment will be taken along, and when you are expected to return. This may involve a separate risk analysis. Seek advice from the station manager for more details on trip plans.

Trip plans can vary from oral presentations and discussions for activities to more comprehensive trip plans specifying details that ensures all activities are conducted and in a safe manner. If you head out for multi-day field trips, most stations require at least a basic trip plan. For shorter outings, sign out/in boards may be sufficient. Always consult the station manager if you are in doubt of what is required.

3.3 Education and training

You may be required to prove certain skills or undergo training before spending time in the field. Certifications, for example for first aid, are offered by many universities or institutions involved in fieldwork. Not only can this training save lives in the field, it can also be a useful skill to have in everyday life. If any team member lacks any of the required skills, ensure that they receive the proper training before heading into the field. It is also useful to practice various things together as a team: for example, crevasse rescue, river crossings, etc. These activities will help you get to know one another.

Set aside enough time for training activities, either at home or before starting your field project. It is essential to learn how to properly handle firearms if you will be working in areas where polar bears occur (Jørn Dybdal).

Examples of safety-related courses include (note this may not be a complete list):

- First aid
- Field safety
- Use of communication equipment (e.g. VHF radios, satellite phones)
- Handling of firearms
- Working around aircraft (e.g. flying drones, helicopter underwater escape training)
- Snowmobile driving
- Driving small boats
- Dealing with wildlife
- Moving in steep terrain
- Glacier travel and crevasse rescue skills
- Avalanche awareness and rescue skills
- Sea- or lake-ice safety
- River crossing
- Climbing
- Diving
- Use of specific instruments or equipment

Ensure that you find out well in advance what training is required or recommended at the station that you will be visiting. Find out where and when you can get this training. It is equally important to include any costs related to training in your fieldwork budget.

3.4 Health and first aid

The remoteness of most INTERACT stations means that any medical emergencies can have far more serious consequences than when at home. It is very important to minimise the risk of any accident and to ensure that conditions like hypothermia are avoided. You need to be in good physical and mental condition, particularly if you will be out in the field for days or weeks at a time. This means ensuring you find a good work-rest balance throughout the duration of your time in the field.

3.4.1 Medicine and chronic illness

If you suffer from any serious chronic or reoccurring illness, it is important that the station management and your team leader (if not the whole team) are made aware of this. While it should not normally restrict your fieldwork, it is good that other team members and the station staff know about any specific symptoms, where your medicine is, and how to use it (e.g. in case of strong allergic reactions, asthma or diabetes). If you need any special medicine, make sure that you have it with you at all times and that at least your team leader (or another team member) is aware of what you are taking, why, typical symptoms, and where you keep your medicine. Make sure to store all medicine at the correct temperature as some don't tolerate being frozen.

3.4.2 First aid

It is highly advisable to carry out at least a basic first aid training course before you head into the field. Ideally, you want to avoid getting into a situation where you will need these skills but you should also know how to identify typical health issues in cold environments, such as hypothermia or frostbite and know what to do about them. Find out well ahead of time where you can do a first aid or a refresher course (if you have already done a course in the past year or two). Indeed, you may even be required to take such a course before going into the field. The resources at the end of this chapter lists several websites with further information, but it might be best to ask at your institute whether they provide special fieldwork first aid training courses.

Appendix C at the end of this book provides an overview of some of the basics of first aid. Note that it is by no means a replacement for proper training.

HANDY TIP
Always make sure you have an adequate first aid kit. You may want to have one extensive kit per team, but with each team member also having their own personal smaller first aid kit.

3.5 Transport

Accidents can happen during transport to stations as well as to and from field sites. Often it is inexperience or lack of attention that leads to incidents, but the use of helicopters, small aircrafts, snowmobiles, boats, and other motorised vehicles is not without danger. It is essential that you are aware of all relevant safety measures and pay special attention when transporting goods and/or people.

3.5.1 Aircraft

You may need to fly by helicopter or small fixed-winged aircraft to the station you are going to visit or from the station to a field camp, if you cannot easily get there by ground transport. You should get detailed instructions from the flight company well before you fly, but here are a few important safety considerations to keep in mind:

- Always await instructions from the pilot or staff member in charge; they are ultimately responsible for your safety.
- During flight operations, do not go on to the heli-pad or airstrip unless authorized to do so.
- Never smoke in or near an aircraft.
- Always wear hearing protection or even a helmet when flying a helicopter and remain seated with seat belts fastened during the flight.
- Know the location and operation of emergency exits.
- Know the location of first aid kits and aircraft survival equipment.
- When loading, unloading, and reloading aircrafts make sure that you follow all safety procedures.
- Always approach helicopters from the front and only after the signal is given by the pilot. Never walk near the tail rotor.
- Loads carried towards a helicopter should be kept low and parallel to the ground.
- If you need to transport any cargo that is flammable, explosive, corrosive, under pressure or poisonous, it is essential that it is properly packed, labelled, and accepted by the aircraft crew to ensure proper handling.

Often helicopters are required to get to various field sites. It is essential that you follow all safety guidelines and particularly the pilot's orders. Near Qikiqtarjuaq, Nunavut, Canada (Jean-Marie Trudeau).

Make sure you are aware of all safety procedures and pack all your gear watertight when you are travelling by boat to your field site (Josephine Rapp).

3.5.2 Boats

While INTERACT is a network of land-based stations, many of them are situated near coasts, rivers, or lakes with field sites that may be accessible only by boat. Factors like rapidly changing weather, cold water temperatures, confused seas (no clear wave direction), freezing water, ice-floes or underwater rocks, some of which may be very difficult to see, and difficult landing places mean that people using small boats must have adequate experience and knowledge. It is important that you are well informed about the area you will be working in, or that you go with someone who knows the region well. It is also essential always to take spare parts, tools, and extra fuel with you.

Sea voyages on small boats (e.g. zodiacs) necessitate strict clothing requirements, such as a certified life jacket and/or immersion suit. Your immersion suit can only offer proper protection when it is completely zipped and with the hood on. In open boats, it is advisable to cover all skin, including the face, since wind and splashing water can result in cold injuries. Wearing insulated rubber boots or regular rubber boots with thick wool socks may also be more comfortable, especially if you will be using a small boat where your feet will be in contact with its metal hull which may be very cold. Finally, make sure that you are aware of all emergency procedures, you have the necessary communication and navigation equipment with you at all times, and ensure all your equipment is packed to be waterproof should your equipment be covered in splashes or fall into the water.

3.5.3 Snowmobiles

In snow-covered and frozen terrain, snowmobiles are often used to transport people and equipment around stations as well as into the field. They should always be used with care as accidents may happen easily. Most accidents are related to driving too fast, inexperienced drivers, and driving in poor visibility, especially in areas with varying snow conditions and uneven terrain.

Some general safety tips before heading into the field, when driving and when transporting cargo on a sled are summarized here.

Before heading into the field:

- Take a course in snowmobile driving or spend time with an experienced driver practicing how to drive safely. In some countries, a car drivers Licence or a snowmobile license is required.
- Make sure that the snowmobile is in good working condition and there is enough fuel for your activity.
- Using a suitable safety helmet is mandatory for snowmobile drivers and passengers (as approved per ECE 22). Skiing and climbing helmets are inappropriate.
- Wear a face mask and a buff under your helmet, ski googles, mittens (warm and windproof gloves over a thin liner glove are recommended), sturdy boots (large enough to accommodate an extra pair of socks and insoles) and ensure that you are dressed appropriately (insulated snowmobile suit). Wear warm layers under the suit and bring extra layers. Never leave skin uncovered as this can easily lead to frostbite and other injuries.
- Check weather forecast and trail/snow/glacier/sea ice conditions before heading out.
- Always have communication and navigation equipment, a snowmobile repair kit and safety equipment with you (see section 3.10).
- In remote and harsh terrain always travel with two snowmobiles together. This will allow one snowmobile to go for help if incidents occur, or to transport people back to the station.

In snow-covered and frozen terrain, snowmobiles are often used to transport people and equipment. Spend time learning how to drive a snowmbile as accidents often happen due to inexperienced drivers and limited visibility (Andrea Schneider).

While driving:

- Agree on clear signals for slowing down and stopping. Since it is usually difficult to hear each other, hand signals are useful. When the driver in front of you gives such a signal, repeat the signal to the driver behind you and follow its meaning.
- Always maintain visual contact but keep enough distance between snowmobiles.
- Drive one by one and behind each other so that you form a line.
- Drive on snow-covered or frozen ground to avoid disturbing wildlife, damaging vegetation and substrate, or the snowmobile. Avoid driving on roads.
- Adapt your speed and driving technique to the conditions, i.e. drive slower in unknown terrain and in poor weather conditions and/or poor visibility.
- Pay attention to changes in the terrain and snow and ice conditions. Stop, check and evaluate if you are unsure. Do not attempt to cross open water or slush.
- In avalanche-prone terrain, drivers and passengers should wear avalanche transceivers.
- In difficult terrain, e.g. with steep inclines, narrow passages, or avalanche terrain, it is recommended to stop before the difficult section, discuss the driving plan and drive one by one. Make sure everyone in your group has passed the difficult terrain before you continue.
- When travelling across sea-ice or glaciers, the second and the last snowmobiles carry rescue equipment. When travelling on glaciers, it is advisable to wear a harness under your snowmobile suit, with the attachment carabiner outside.
- Many incidents occur when parking and starting snowmobiles. Whenever there is space, park snowmobiles next to each other in a line (instead of behind each other). When starting, drive out one by one in the same order. When parking near potentially dangerous places, such as on sea-ice in front of a tidewater glacier, always park in the direction facing AWAY from the potentially hazardous zone and next to each other. This allows you a fast retreat if necessary, i.e. without having to turn first.

If you are transporting equipment with a sled towed behind a snowmobile:

- When packing the sled, place the heaviest items near the balance point (in the middle and at the bottom); smaller items in sled bags (if available) and the emergency equipment easily accessible on top. Try to fill the sled from edge to edge to avoid movement but avoid loads that are too heavy.
- Use taut-line/ratcheted straps or trucker's hitches to tie gear down since they are easy to undo and re-tighten. Make sure that all straps are flattend, twisted straps may loosen or break.
- Drive slowly in uneven terrain since you do not want the sled to tip over.
- Check your sled and cargo periodically, in particular in uneven and/or steep terrain.
- When driving on sea-ice let a single snowmobile without a sled drive first. Follow the same track still keeping a good distance between the snowmobiles.

3.5.4 Vehicles (Automobiles and ATV's)

Some INTERACT stations are accessible by road and vehicles can also be used to get into the field. When driving to or around a station it is essential that you adhere to all national traffic regulations and drive safely according to the conditions, especially in bad weather or on snow or ice. Make sure you are aware of whether cars or other motorised vehicles are used to get around the station itself and follow all rules accordingly. When walking on roads in darkness or stormy weather with poor visibility, stay on the sides and wear bright clothing or a reflective vest.

In some places you might be able to drive to the station and even your field site by car. Ensure you always drive safely according to conditions and follow the national traffic regulations (Ruth Vingerhagen Hindshaw).

Note that in Europe it is typical to have manual transmission cars, so if you are used to driving only an automatic transmission car, you may have to either learn to drive a manual or to find someone who can drive for you. Depending on the terrain you may also be required to learn to drive a 4x4 vehicle. Make sure you find out in advance what type of transmission the cars that you will be using have.

3.6 Risks at the station

A surprising number of incidents and accidents happen in and around research stations, partly because people may feel more comfortable when near or at the station and are thus less attentive. Accidents may happen in the kitchen, in workshops or labs, or even when teams are eagerly on their way back after a stay out in the field. Just because you may feel more at 'home' when at or close to the station it is important not to take any unnecessary risks. Given the remoteness of most INTERACT stations and the distance to proper medical facilities, it is important that every effort is made to avoid accidents. This section outlines some of the main risks at or near stations and how you can avoid them.

Kluane Lake Research Station, Canada (Morten Rasch)

3.6.1 Fire

Some stations in the Arctic and in northern Alpine areas are located in relatively dry environments with little or no running water available. Being in a remote location also means that you cannot count on assistance from the fire service. If a fire occurs at a station (or in a field camp), the consequences can be severe since it may be very difficult to extinguish the fire. It is therefore vital to prevent fires from happening. Be extra careful if you are working in the kitchen, in laboratories with flammable substances, and with any electrical appliances. Keep a good distance to buildings and tents when making campfires.

Make sure you are aware of what to do in case of fire, for example, memorize the location of emergency exits and fire extinguishers. The station staff should explain the relevant procedures and what is expected of you when you arrive at the station. If the station is unstaffed, make sure you familiarise yourself with the procedures following any written guidelines provided. Only smoke outdoors and never throw cigarette butts on the ground.

3.6.2 In the kitchen

Perhaps the largest number of accidents happen in the station kitchen, whether it be from sharp knives, hot water, heat from an oven or lifting heavy items. It is essential that care is taken when you work in the kitchen and that you follow all station safety procedures. Make sure the kitchen is well ventilated, do not use any equipment that you are not completely familiar with, and pay extra attention when working with hot items either on stoves, around ovens or elsewhere. Always make sure that all equipment and utensils are safely stored in the correct places and all appliances are switched off and correctly stored when not in use.

3.6.3 Electricity

Most INTERACT stations have electricity, whether this be from renewable sources, generators or from the grid. It is vital that you follow all regulations regarding the use of electrical outlets and devices. Also make sure that you are aware of the voltage available, since this might not be the same as at home. If necessary, you may need to use an adapter. Ask station staff before you leave home if in doubt. It is also advisable to never leave charging devices unattended.

3.6.4 Hygiene

Some INTERACT stations may not have showers or running water. This, however, should not be an excuse to ignore personal hygiene. It is essential that you help preventing the spread of illnesses and contamination of food by ensuring you keep a normal standard of personal hygiene, e.g. by washing or disinfecting your hands before handling food and eating, after using the toilet, etc.

You will also likely be sharing confined spaces with other people so to ensure their comfort and yours, keep yourself and your belongings as clean and hygienic as possible. While you may not be able to shower as often as you would at home (if at all), using for example, wet wipes or a sponge to clean yourself can go a long way for the comfort of all. Alcohol hand gels can also be a very effective way to clean and sanitise your hands, especially if water is limited.

Being in a different environment and quite possibly under more stress than usual means that women may get a lighter and shorter period than normal. You may even miss your period entirely if you are particularly stressed before and during your fieldwork. If you do use tampons and sanitary pads never bury them, but rather make sure that you take them with you as part of the rubbish that gets packed and brought back out. Small plastic bags can be useful to take with you to wrap up any sanitary items - these are useful to bring in addition to any other regular toiletries.

3.6.5 Laboratory work and chemicals

While at the station you may spend time using laboratory facilities. Before using any work areas, instruments or equipment, make sure you communicate with the station staff and acquaint yourself with all safety procedures. Quite obviously, make sure you follow these procedures at all times! Use relevant protective equipment, i.e. overalls, gloves, goggles, etc.

Should you be working with chemicals, radioisotopes or any other hazardous substances, make sure that you keep the work area well ventilated and transport or store any such substances in specific approved containers. Ensure that chemicals are marked and stored in the correct place. Keep all hazardous substances away from heat sources, sharp appliances, food, etc.

For environmentally hazardous waste contact the station staff before you pour anything down the sink; the drain often goes straight out into the natural environment. Make sure that you wash and return all equipment and material to its proper place.

If you use the station's laboratory facilities, make sure you acquaint yourself with all the safety procedures and work tidily (Mar Fernandez Mendez).

3.6.6 Workshops and equipment use

Some INTERACT stations may have workshops where equipment and instruments can be worked on or repaired. Accidents can happen very easily and it is essential that you know what you are doing and have permission to do so. Before using any of the tools or equipment in the workshop, ensure you have permission for your activity, make sure you follow all procedures outlined by the station staff and always ask for help if you are unsure of anything. Should you need to work with any heavy equipment or machinery make sure you have help. Once you are finished in the workshop, make sure you leave the facilities neat and tidy and return everything back to where you found it.

3.7 Risks in the field and at the camp

You may face many risks when out in the field, particularly if your fieldwork entails potentially dangerous activities such as working on glaciers or sea-ice, working in areas with wildlife or steep terrain. Some obvious dangers, such as moving in steep/avalanche-prone terrain, are to some extent unavoidable, but by taking all the right precautions you can minimise the risk significantly. It is important to be very careful when you are out in the field since it is likely that you will be even further from any medical assistance or rescue than when at the station.

3.7.1 Field camps

Field camps need to be set up properly, particularly if you are going to be out for several days or weeks at a time. There are a number of important aspects to keep in mind when camping:

- You may want to talk to the station staff or any others with local knowledge for suggestions about good campsites.
- Consider the topography to make sure that you place your camp in an area where snow avalanches are not going to hit, where you will not be exposed to falling rocks, mudslides or slush avalanches, away from crevasses if on a glacier or away from the glacier front.
- Calving tidewater glaciers can generate huge waves and glacial lake outburst flows can travel downstream on rivers and flood its banks, even at large distances away from the glacier. When camping on a riverbank, find out what the geography upstream the river is like. In addition, water levels tend to be higher in the afternoon/in the melt season.
- Choose a site close to a source of running water and/or clean snow.
- Make sure to orientate your tent according to the predominant wind direction; place your tent with the entrance facing away from the predominant wind. It is important to consider wind channels such as narrow valleys and strong katabatic winds coming down from glaciers.
- Stay away from any areas commonly visited by wildlife (e.g. drift ice, certain areas on riverbanks or migration routes). Look out for footprints, paths in vegetation, and droppings which may indicate often used trails or areas.

It is a good idea to plan the camp layout and put up the tents in daylight. The plan may include where the sleeping tents will be located; where the mess/common tent will be located (if any); where food, fuel, and garbage will be stored; where drinking water will be collected (along rivers, this should be upstream of the camp); where toilet or latrine facilities will be established (along rivers, this should be downstream the camp); and where firearms and ammunition will be stored.

HANDY TIP
Make sure you are familiar with how to set up your tent before going into the field.

HANDY TIP
If you lose or break your tent pegs, you can always use rocks, skis, hiking poles or anything else appropriate to tie down your tent.

Consider the terrain when choosing your campsite. Plan the camp layout and put up tents in daylight. The tents should be orientated according to the predominant wind direction (Andrea Schneider).

3

Depending on what type of ground you plant your tent on, you may want to make it as flat as possible, for example, by removing rocks or compressing the snow underneath and around your tent. Make sure that your tent is securely anchored and check the guy lines daily; loose lines can make tents more prone to damage in strong winds. If you are in a region where there are frequent snowstorms and whiteouts, ensure you mark out the camp with stakes so that even in complete whiteout conditions you do not get lost within the camp. You may also want to consider building a snow or rock wall around your tent to protect it from the wind.

You may want to insulate your tent with an extra ground sheet; this protects well against the cold and in areas where the ground is wet. Make sure that you have an adequately warm sleeping bag as well as a foam or inflatable air mattress. Down sleeping bags are lighter and pack down smaller. However, if you are allergic, there are many options for synthetic sleeping bags. You may also want to bring a sleeping bag liner for extra warmth (and for hygiene, since the liner is much easier to wash than the sleeping bag itself).

If setting up several tents for a team, make sure there is a good distance between each tent to minimise the risk of fire. Store food and fuel away from the sleeping tents and so that it will not attract wildlife. Remember that bears and other animals are attracted to the smell of places where food is kept or has been cooked. Therefore, it is important to clean all dishes and stoves properly, and store food and garbage in airtight containers. Latrine facilities should be set up a good distance from the camp as well as any fresh water sources (see section 1.9 on environmental considerations).

For specific information on camping in (polar) bear country, consult the station website or manager before leaving home, and see section 3.8.7. When staying in a cabin in (polar) bear country do not automatically assume that cabins are safe places. There have been several incidents particularly on Svalbard, Norway, with polar bears breaking into cabins by smashing doors or squeezing their bodies through seemingly too small windows to eat the food that was stored inside the cabin. In bear country, you always need to be on guard – see section 3.8.7 for more details.

3.7.2 Cooking and water treatment

While out in the field you will likely be cooking your food on some form of gas or liquid fuel stove. Before heading out, make sure you test the stove and know how the stove functions as well as how to repair it. There are several safety issues to keep in mind when using a stove:

- Make sure there is adequate ventilation. Dangerous amounts of carbon monoxide (CO) can accumulate in poorly ventilated enclosed spaces such as a tent or a cabin, or when fuel does not burn properly. CO is an colourless, odourless, tasteless, and highly toxic gas. It displaces oxygen in the bloodstream and thus it is extremely dangerous.
- Make sure that you have the correct fuel blend. For example, in cold temperatures you will need a propane-butane mix rather than just propane gas. Ensure you have the correct liquid fuel for your stove.
- If you need to refill a liquid-fuel canister, do this very carefully with a designated pair of gloves. Skin contact with super-cooled fuel can cause instant frostbite and residues of evaporated gasoline can be combustible.
- Check your stove and fuel canisters for leaks before every use.
- Pack stoves and fuel away from food.
- Do not cook inside small tents, except in emergencies (again, making sure the tent is well ventilated).
- Bringing a spare stove and/or a repair kit can be a very good idea. Ideally, the spare stove should be of the same model as the one(s) you normally use.

If you are staying in a cabin or a field hut, it is equally as important to make sure that it is well-ventilated when you are cooking or heating with a stove. Even when it is cold outside, leave a window slightly open to ensure there is enough fresh air – CO poisoning is a serious danger but can be easily avoided.

In the field you might get fresh water from a stream, river, lake or by melting fresh snow. Depending on where you are, you may need to treat your drinking water. The easiest way to do this is to boil all water for at least three minutes, but you could also consider using water purification tablets (usually containing iodine or chlorine), although these take between 30-120 minutes to take effect. Other options include various water filters, although these can be bulky, heavy, and time-consuming, particularly if you have to pump the water by hand. Remember that water purification may not necessarily remove any toxins. Therefore, be aware of any possible chemical contamination of drinking water. Snow and glacier water is depleted of minerals and salts. Make sure that you get these minerals and salts through your diet or by adding a pinch of salt to your water.

A field team participating in a shooting course arranged by the University Centre on Svalbard (Katrine Raundrup).

3.7.3 Firearms

There are some places in the Arctic where the danger from wildlife will mean that you need to carry a weapon, flare gun/signal pistol or pyrotechnics (such as firecrackers, handheld flares) with you (e.g. on Svalbard, Norway; in parts of Greenland; or in some parts of Alaska, USA; Canada; and Siberia; Russia). A rifle with 30-06 calibre bullets is generally considered the best firearm for polar bear protection.

Before you are allowed to carry a firearm, however, you will very likely need to complete a safety training course where you will learn how to safely handle the firearm you will be working with. Find out before you leave if you will need to carry a firearm, and if so, whether you need to complete a training course. Make sure you arrange enough time to complete the course before you go out into the field.

Some very general rules about handling and establishing good routines around firearms are summarized here:

- Train how to use the firearm that you will be using.
- Understand what important terms mean:
  - Signal pistol/flare gun = handgun used for firing flares. Used as deterrent to scare off polar bears and muskoxen.
  - Firearm (in this context) = rifle suited for polar bear protection.
  - Half loaded = magazine is filled with ammunition while ensuring that the chamber is kept empty.
  - Loaded = ammunition is in the chamber.
  - Emptying the firearm = remove ammunition from the magazine and ensure the chamber is kept empty. Visually inspect and feel inside the chamber and magazine with a finger to make sure there is no bullet.
- Never point a firearm at someone.
- Always check that the firearm is empty when you receive or give it to someone.
- Check that the firearm has no damage and that the sights are present and centred.

- As a main rule, firearms should be carried and transported empty. Ammunition should be stored easily accessible in a separate holder or in an outer pocket in your clothing. In rare circumstances where close encounters with wildlife are expected, you may transport the firearm half-loaded. Never leave or hand over a half-loaded or a loaded firearm without communication. When putting down the firearm, place it so that it will not fall.
- Carry the firearm so everyone can see that it is empty (bolt open or removed, the muzzle pointing upwards) near people or buildings.
- Always check for a safe background before firing a firearm.
- Ensure dust- and waterproof packing of firearms during transport. When you have a firearm in the field, you may want to cover the barrel opening with tape to avoid dirt, snow, and ice from entering the barrel while still allowing the bullet to penetrate in emergencies.
- Leave firearms outside in very cold conditions as this avoids condensation and freezing of moving parts.

Be aware of any rules regarding storage and transport of firearms and ammunition. Rules and regulations may vary between different countries and stations. Hence, it is your responsibility to ensure that everything is done safely. If in doubt, ask more experienced colleagues or the station staff.

Field work in polar bear area, Northeast Greenland (Bo Elberling).

3.7.4 Extreme activities

As part of your fieldwork you may be required to do other specialised activities such as diving, glacier cave exploring or climbing. We cannot cover all details regarding these activities here, however, just as for other aspects of your fieldwork it is essential that you are well prepared for these activities, have taken all the proper training courses and have all the required safety equipment.

3.8 Natural hazards

3.8.1 Weather change

The weather in the Arctic and northern Alpine regions can be extreme and can change surprisingly rapidly. You need to be prepared for strong winds, cold, wet weather and limited visibility due to fog, snowfall or wind swirling up loose snow at any time of the year. In addition, weather conditions can be influenced by many local factors, e.g. narrow valleys and proximity to the sea or large glaciers. This means that being informed about expected weather conditions for the period you will be in the field (to the extent possible) and being prepared by carrying the right equipment and clothing to face the elements is essential. The station staff should be able to provide you with the latest weather forecasts.

The weather in the Arctic and northern Alpine regions can be extreme and can change surprisingly rapidly. Disko Island, Greenland (Morten Rasch).

HANDY TIP

Obtain the latest weather forecast whenever possible. Also ask the station staff (if the station is staffed), whether there are specific weather phenomena or particular local conditions to watch out for. It may be that storms are often preceded by particular cloud types or that particular areas are especially vulnerable to strong winds.

HANDY TIP

Strong wind can destroy tents and other equipment. Setup your tent in a sheltered area whenever possible, avoid wind channels and be prepared to build an emergency shelter should you ever get into the situation in which your tent is damaged beyond repair or you cannot easily get back to the station. The most important thing is to protect yourself from the wind to stay warm. If you are in a snowy environment, you can dig a snow trench or make an igloo. Should you be on sea-ice, reposition snowmobiles to provide as much protection as possible. If you are in a rocky environment, build a small wall behind which you can shelter from the wind. In addition, small and lightweight emergency bivouac bags offer good wind protection.

In the Arctic, it is usually not the cold temperatures alone that pose challenges, but the combination of low temperatures and strong winds as well as limited visibility. Bad weather can last for several days and you may need to stay at your field camp or at the station if such weather is expected. Always pack extra clothes and food, even if good weather is predicted. Remember, wind chill can have a dramatic effect on the temperature felt, which may be many degrees less than the actual temperature forecast (see Table 3.1). For example, winds with 10 m/s at 0 °C can feel like -7 °C. Follow the station's communication protocol (i.e. use of radio, satellite phone, etc.) should the weather change and you need to stay longer at your field camp, get lost or require assistance of any kind.

Wind		Temperature										
m/s	knots	°C | °F										
0	**0**	**10 | 50**	**5 | 41**	**0 | 32**	**-5 | 23**	**-10 | 14**	**-15 | 5**	**-20 | -4**	**-25 | -13**	**-30 | -22**	**-35 | -31**	**-40 | -40**
2	4	9 | 48.2	3 | 37.4	-2 | 28.4	-8 | 17.6	-14 | 6.8	-20 | -4	-26 | -14.8	-32 | -25.6	-37 | -34.6	-43 | -45.4	-49 | -56.2
4	8	8 | 46.4	2 | 35.6	-4 | 24.8	-10 | 14	-17 | 1.4	-23 | -9.4	-29 | -20.2	-35 | -31	-41 | -41.8	-47 | -52.6	-53 | -63.4
6	12	7 | 44.6	1 | 33.8	-5 | 23	-12 | 10.4	-18 | -0.4	-25 | -13	-31 | -23.8	-37 | -34.6	-44 | -47.2	-50 | -58	-56 | -68.8
8	16	7 | 44.6	0 | 32	-6 | 21.2	-13 | 8.6	-19 | -2.2	-26 | -14.8	-32 | -25.6	-39 | -38.2	-45 | -49	-52 | -61.6	-58 | -72.4
10	19	6 | 42.8	0 | 32	-7 | 19.4	-14 | 6.8	-20 | -4	-27 | -16.6	-34 | -29.2	-40 | -40	-47 | -52.6	-53 | -63.4	-60 | -76
12	23	6 | 42.8	-1 | 30.2	-8 | 17.6	-14 | 6.8	-21 | -5.8	-28 | -18.4	-35 | -31	-41 | -41.8	-48 | -54.4	-55 | -67	-61 | -77.8
14	27	5 | 41	-1 | 30.2	-8 | 17.6	-15 | 5	-22 | -7.6	-29 | -20.2	-35 | -31	-42 | -43.6	-49 | -56.2	-56 | -68.8	-63 | -81.4
16	31	5 | 41	-2 | 28.4	-9 | 15.8	-16 | 3.2	-22 | -7.6	-29 | -20.2	-36 | -32.8	-43 | -45.4	-50 | -58	-57 | -70.6	-64 | -83.2
18	35	5 | 41	-2 | 28.4	-9 | 15.8	-16 | 3.2	-23 | -9.4	-30 | -22	-37 | -34.6	-44 | -47.2	-51 | -59.8	-58 | -72.4	-65 | -85
20	39	5 | 41	-2 | 28.4	-9 | 15.8	-16 | 3.2	-23 | -9.4	-31 | -23.8	-38 | -36.4	-45 | -49	-52 | -61.6	-59 | -74.2	-66 | -86.8
22	43	4 | 39.2	-3 | 26.6	-10 | 14	-17 | 1.4	-24 | -11.2	-31 | -23.8	-38 | -36.4	-45 | -49	-52 | -61.6	-59 | -74.2	-67 | -88.6
24	47	4 | 39.2	-3 | 26.6	-10 | 14	-17 | 1.4	-24 | -11.2	-32 | -25.6	-39 | -38.2	-46 | -50.8	-53 | -63.4	-60 | -76	-67 | -88.6
26	51	4 | 39.2	-3 | 26.6	-10 | 14	-18 | -0.4	-25 | -13	-32 | -25.6	-39 | -38.2	-46 | -50.8	-54 | -65.2	-61 | -77.8	-68 | -90.4
28	55	4 | 39.2	-3 | 26.6	-11 | 12.2	-18 | -0.4	-25 | -13	-32 | -25.6	-40 | -40	-47 | -52.6	-54 | -65.2	-61 | -77.8	-69 | -92.2
30	59	4 | 39.2	-4 | 24.8	-11 | 12.2	-18 | -0.4	-26 | -14.8	-33 | -27.4	-40 | -40	-47 | -52.6	-55 | -67	-62 | -79.6	-69 | -92.2
32	63	4 | 39.2	-4 | 24.8	-11 | 12.2	-19 | -2.2	-26 | -14.8	-33 | -27.4	-41 | -41.8	-48 | -54.4	-55 | -67	-63 | -81.4	-70 | -94

Cold Index			
0 °C to -20 °C | 32 °F to -4 °F	-20 to -40 °C | -4 to - 40 °F	-40 to - 60 °C | -40 to -67 °F	below -60 °C | below -67 °F
Minimal risk, but false sense of security at prologued stay	Increased risk level, lighter frostbites of exposed skin	Danger, frostbite of exposed skin within a short time	Grave danger, immediate frostbite of exposed skin

Table 3.1 Calculation of the Wind Chill Factor from temperature and wind speed. The wind chill factor describes the real temperature felt as a result of temperature and wind speed. Increasing wind speed decreases the temperature experienced considerably. Remember that humidity has a strong effect on the temperature felt.

Image modified from: Danish Meteorological Institute.

3.8.2 Glacier fieldwork

Travelling over glaciers, whether by snowmobile, on foot or on skis, requires special equipment and skills. Crevasses (cracks in the ice), snow bridges, melt water channels, melt water holes (moulins) and tidewater glacier fronts all pose risks, as can bad weather conditions, which can greatly increase the danger of travelling over glaciers. It is essential that you are trained in glacier travel and crevasse rescue techniques. There are various methods and here we do not aim to provide an overview or suggest one specific technique over any other. Inform yourself about where you can get the appropriate training (this may be a national mountain sports club or a specific training centre) and make sure to practice these techniques with your team before going into the field.

Some general tips for safe travel on glaciers:

- Never go on to a glacier alone.
- Make sure you are properly trained in glacier travel and crevasse rescue techniques.
- Always have appropriate equipment with you (see section 3.10.5 for details).
- Never head out on to glaciers in bad visibility. Obtain the latest weather forecast before heading out and be aware that conditions can change rapidly.
- Follow known or marked routes and GPS tracks (if available). However, you should always be careful about older routes. Glaciers are dynamic and conditions change quickly, which means that previously safe routes may no longer be safe because of the formation of new crevasses and/or moulins.
- If you are unsure about ice or snow bridge stability, stop and probe the area around you with an avalanche probe.
- Even on warm days, keep your hands, arms, and legs covered as ice and small rocks can be sharp to protect you if you fall.
- Avoid areas with visible crevasses, irregular surface, and steep sections; this is where most crevasses occur.
- Also be aware of meltwater channels; these often occur on the sides of glaciers.
- Keep good distance from the glacier front, especially the fronts of calving tidewater glaciers as they often shed large blocks of ice. This is also important in front of surging (i.e. very fast moving) glaciers. Note that all glaciers release running water at the front, some even in winter, and this may cause serious difficulties.
- Move carefully in adjacent moraine areas. The rocky moraines around and in front of glaciers can be unstable. They may hold dead ice that is covered by only a thin layer of rocks and sediment, or holes from melting dead ice (kettle holes) may occur.

Glacial lakes form from water trapped behind, inside or below glaciers. Over periods of months to years, they often undergo a cyclic process of filling, draining, and then refilling again. While they appear stable most of the time, when they do burst, they can cause dangerous floods, particularly since they are largely unpredictable.

Staying safe around glacial lakes means:

- Find out if the glacial lake you will be visiting has a history of outbursts, sometimes these can occur roughly at the same time each year.
- Be aware of any sudden changes in water level or clarity, as well as flow into the lake.
- Store any gear and camp well above the high tide line and away from the outflow area of the lake.
- Glacial lake outburst flows can travel downstream on rivers and flood its banks even at larger distances. When camping at a river bank, it is important to know what the geography upstream the river is like.
- When kayaking, make sure to stay far enough away (at least 500 m) from the glacier terminus since iceberg calving activity can create big waves.

Numerous large crevasses commonly occur at the front of tidewater glaciers that may shed large icebergs. Tunabreen on Svalbard, Norway
(Katrin Lindbäck).

3.8.3 Snow avalanches and cornice falls

Snow avalanches can travel well over 150 km/h; a force which can easily push you over cliffs and into rocks or trees. If you do survive the initial trauma, you may find yourself buried under a mass of concrete-like snow; very often the friction of sliding downhill heats and melts the snow, which then refreezes around you. Survival rates of fully buried victims dramatically decrease after 15 minutes.

Cornices are overhanging bulges of snow on a ridge, the crest of a mountain, along the sides of gullies or ravines. They can form by wind blowing snow over sharp terrain edges where the snow attaches and builds out horizontally. This build-up is most common on the steeper and lee-ward sides of mountains. Cornices are particularly vulnerable to collapse during periods of temperature increase. They can be extremely dangerous and travelling above or below them should be avoided. Cornices breaking off and falling on to the snowpack underneath and can also trigger avalanches.

The best protection is to avoid getting caught in a snow avalanche or being hit by a cornice fall. Being able to read snow conditions and the local terrain helps to avoid getting into a dangerous situation in the first place. If you expect to travel through avalanche-prone terrain, it is essential that you attend an avalanche training course (or ideally several). This is particularly true for avalanche training, since the best-practice advice and rescue techniques are often updated or changed. It is vital that you always carry an avalanche transceiver, probe and shovel, and are proficient in using them. Carry your avalanche transceiver close to your body and covered by at least one layer of clothing, not in an outside pocket or in your backpack as avalanches can rip off such pockets and backpacks.

Never travel alone in snow avalanche terrain. Before going out into the field, ask the station staff about local snow conditions and if there are any particular areas that might be particularly prone to avalanches. Always keep in mind that snow avalanches and cornice falls are extremely hard to predict and can even occur in places where they have never been observed before.

Avoid avalanche-prone terrain in darkness and bad weather. Be extra careful after periods with heavy snowfall and wind, and temperature fluctuations. This kind of weather pattern not only increases the risk of avalanches being released but also builds up cornices that subsequently can become unstable.

In terms of terrain, there are three aspects to pay particular attention to:

- **Slope angle**: Snow avalanches occur most frequently at slope angles of 30-45°. Use maps, if they exist, to plan a safe route before you go out. While travelling through backcountry terrain, stop and estimate the slope steepness with a clinometer or other technique if ever in doubt.
- **Slope aspect**: The slope exposure can dramatically change how snow transforms. Sunshine will act to melt and condense snow. In the winter season this often stabilises slopes, while in spring and summer this may lead to more serious melting and dangerous wet-snow slides.
- **Terrain hazards**: There are various terrain types that should be avoided because snow avalanches may be more likely there (e.g. on convex slopes, on wind-loaded lee slopes, or below cornices) or because avalanches could potentially transport you into dangerous territory with no escape route (e.g. above cliff bands or flat areas below steep slopes). Snow often accumulates in steep, narrow gullies (couloirs), so these should also be avoided.

Weather strongly impacts the stability of snow (Fiona Tummon).

Remember, avalanches can be triggered from both above and below. Keep good distance from any run-out areas, i.e. below dangerous slopes or cornices.

The weather plays a predominant role in affecting avalanche risk. Again, there are three main factors which affect the snowpack stability:

- **Precipitation**: The snow is least stable during or immediately after periods of heavy snow fall. This is particularly the case if the falling snow is different from the snow layer it lands upon, i.e. wet, dense snow falling on lighter powder snow, or light, dry powder snow falling on an icy, hard layer. Rain can also destabilise the snowpack considerably since it tends to percolate through into deeper layers of the snowpack, serving as a lubricant and making the snow package more prone to sliding.
- **Wind**: Wind transports snow, and the stronger the wind, the more snow may be transported. Pay attention to the direction and strength of the wind, avoiding areas in the lee, where wind-caused snow accumulations, and/or cornices are likely to build up. Changing wind directions can make these zones very difficult to identify, so it is essential that you are well-trained and aware of danger signs.
- **Temperature**: Temperature fluctuations can significantly affect snowpack stability and cause changes in snow crystal formation. The most dangerous crystal type is known as 'hoar' and may form on the surface or within the snowpack if temperature differences are large. Hoar snow is similar to granulated sugar and barely bonds with the surrounding snow, effectively providing a 'slippery' layer, which renders the snowpack highly unstable. These layers can, once formed, remain hidden in the snowpack for much of the season, so it is important you inform yourself, where possible, of the seasonal evolution of the snowpack. If no such information is available and you have to travel through steep terrain, make sure you know how to properly make a snow profile to identify such layers and how to interpret snowpack stability. Be aware that this requires a lot of experience.

3.8.4 Steep terrain: Rock avalanches, rock falls, and mud slides

Rock avalanches occur when a rock slope fails and a large volume of stone falls from a mountainside, usually at very high velocities and with long run-outs. They most often occur on steep, unstable slopes. Commonly it is the combination of these factors together with weaknesses in the underlying bedrock or water saturation that triggers them. Rock avalanches are probably one of the most dangerous geological hazards, particularly if the rocks fall into a fjord or lake where it may create a tsunami. The timing of rock avalanches is difficult to predict and outside of regions where infrastructure might be threatened, the risk of rock avalanches may not be well known, if at all.

Steep terrain

When you are working in steep terrain or travelling through it, make sure you remain aware, particularly in areas with loose rocks and sparse or no vegetation, and after heavy rain events or during the snow melt season. Take appropriate safety measures, such as working in good visibility, wearing helmets, using rope protection when applicable, consider using hiking poles and ensure your gear does not fall.

Rock avalanches occur when steep, unstable rock slopes fail and fall. They are one of the most dangerous geological hazards related to field work and are usually very difficult to predict (Fiona Tummon).

Rock falls occur far more frequently than rock avalanches but are of a much smaller scale. As the name suggests, a rock fall consists of one or more smaller or larger stone blocks that fall off a mountainside. Even a small rock fall can do a lot of damage, so if you are working in an area with cliffs or steep slopes, make sure to wear a helmet and protect your equipment adequately. Take care not to destabilise or start rock falls in steep terrain with loose rocks – especially when there are people below you.

Mud slides or mud flows can also occur in steep terrain. They are defined as mixtures of soil, rocks, and water that move rapidly downwards, especially after heavy rainfall and during snowmelt. Their scales can vary from very small to large, and they usually leave scars in the slopes they slide through. Areas where mud slides occur can therefore usually be identified relatively easily and can thus be avoided.

3.8.5 Sea-ice or frozen lakes and rivers

While INTERACT is a network of terrestrial stations, many are located close to lakes, rivers or the sea. In winter, this means access to frozen lakes, rivers, and sea-ice, all of which can be dangerous to travel over. Before going out onto any form of frozen water, make sure you discuss the current conditions with the station staff. They should be aware of the recent evolution of the ice and will be able to let you know of any particular dangers to watch out for. It is also advisable to consult sea-ice thickness charts and forecasts, satellite images, weather forecasts, and tide charts, if they are available. These products, together with local knowledge from those who have recently travelled over the ice, can provide information to help you plan your excursion.

The University Centre in Svalbard recommends that you only travel across and work on sea-ice if its thickness is:

- >12 cm and you are travelling on foot or with skis.
- >30 cm and you are travelling on a snowmobile.
- >30 cm at -15 °C or > 50 cm at -2 °C and you are travelling in a vehicle of 3 tonnes or more.
- In addition, keep in mind that lake-/river-ice and sea-ice have different physical properties and thus stability. According to the Tarfala Research Station in Sweden, blue lake-ice should have a thickness of at least >10 cm when travelling on foot or on skis.

While INTERACT is a network of terrestrial stations, many are located close to lakes, rivers or the sea and thus offer access to frozen lakes, rivers and sea-ice. Always bring safety equipment and know the thickness of the ice (Jean Negrel).

Keep in mind that the thickness and stability of the ice can be reduced by different factors, for example, strong currents and weather changes (e.g. strong warming or wind). Expect weaker ice near river mouths, in front of tidewater glaciers, around icebergs (they can tilt even when they are frozen into the ice), pressure ridges, gas outlets under the ice, seal holes, islands, and close to settlements where ship traffic may break the ice or warm water outlets occur.

It is recommended to constantly check the ice thickness and quality (e.g. with a hand drill) when crossing regions of unknown ice thickness. If in doubt, always stop and check the ice thickness before travelling further. Always carry the proper safety equipment with you. This includes a probe to test and measure the sea-ice thickness, a rope/throw-rope and ice spikes (these should always be around your neck, see section 3.10.5 for further details).

Be especially alert at the start and at the end of the sea- and lake-ice season, when thin ice, slush or water above the ice occur more often. Always pay attention to the colour of the ice and snow. Changes in colour can indicate changes in ice thickness or surface conditions as the overlying snow can be slightly darker when it is wet.

Poor visibility is also a significant danger when travelling over frozen water, since it can obscure the surface conditions and changes in the ice, cracks or any obstacles will be hard to detect. Adjust your speed accordingly when travelling with snowmobiles and do not attempt to cross open water areas or slush.

3.8.6 River crossings

Crossing rivers can be dangerous for several reasons. The water may be extremely cold, currents may be strong, there may be deep channels and/or fast running waters that are not visible from the shore, and often unstable or slippery rocks occur. Weather conditions also strongly affect water levels, which may rise significantly after heavy precipitation or strong snow/ice melt. Should you need to cross a river, keep the following safety measures in mind:

- Never cross a river alone, always be at least two or more people.
- Even smaller water courses can be difficult to cross since algae often grow on the stones and make them slippery.
- Cross rivers where they are broad and shallow rather than where they are deep and narrow.
- It is usually advised not to use a rope. If one person gets swept away, they might pull all the others with them. Rather go in small teams or one at a time, so that someone can still perform a rescue if necessary.
- Always loosen your backpack straps before crossing in case you need to drop it quickly, should you fall.
- Use boots with a coarse-patterned sole. Bring hiking poles or a stick and use them to assess the depth and help keep your balance while crossing.
- Never cross barefoot as you may lose feeling in your feet if the water is too cold (if you have a pair of sandals, you may consider using these though).
- When working near deep and fast flowing water, consider wearing a helmet and glacier type harness that is attached to a rope, which is in turn fixed to a solid bolt in the rock or a large and stable boulder.
- If the river is affected by ice or snow melt, the flow will often be higher in the afternoon (when there is more melt water).
- Never use waders without wearing a life jacket.

A group looking for a suitable place for crossing a river on Blomstrandhaløya, Svalbard, Norway
(University Centre on Svalbard).

Extreme rain, spring melt events and glacial lake outburst flows can rapidly increase river water levels. Emptying of a glacier lake 11th-12th August 2009, A.P. Olsen Land, Northeast Greenland
(automated camera, Greenland Ecosystem Monitoring programme).

3.8.7 Wildlife

While there are not many dangerous animals in most of the northern Alpine regions where INTERACT stations are located, there are several in the Arctic. They include polar bears, brown and black bears, muskoxen, wolves, foxes, walruses, seals, and even whales.

In all cases, the best way to ensure there are no incidents with these animals is to avoid them in the first place. Be aware of your your surroundings, keep your eyes open for animal tracks and droppings, and try to choose travel routes with a clear view of the area at all times. If you are going to be staying stationary in one area for a while, you may want to consider taking turns to watch out for wildlife. Indeed, this is strongly encouraged in areas with bears. As a general rule, stay at least 100-200 m away from any wildlife, especially feeding predators. This also includes whales, seals, and walruses, since they can easily capsize or pierce kayaks or zodiacs. Even greater precaution should be taken in areas with bears and wolves. Other species such as mice or other rodents may cause minor injuries that are of no direct danger but should be avoided because of the risk related to infections from bites and scratches.

Remember, you cannot outrun any of the larger wild animals (foxes, wolves, muskoxen, bears, etc.). Many species will see running away as an incentive to attack, so it is usually advisable to remain calm and back away slowly from any animal while still facing them. Another strategy can be to appear as big as possible with a team of people (to imitate one large animal). Also, never feed any wild animals – big or small. Finally, do not leave any items such as boots or backpacks outside your tent, they may attract wild animals (and might not be there when you wake up in the morning).

Arctic foxes and dogs

Foxes and dogs can carry the zoonotic rabies virus, which can be deadly if you are bitten and not treated within 48 hours. Rabies is known to occur almost all over the Arctic and it is important not to touch any carcasses. If you know you are going to work with foxes or dogs, it is advisable to get a rabies vaccination prior to going into the field. Animals exhibiting strange behaviour or showing indications of disease should be avoided. In general, consider taking a sturdy walking stick that you can use to fend off any attacking fox or dog. If an aggressive animal does come your way; avoid showing fear – it will perceive this as a sign of weakness and will be more likely to attack; avoid showing your teeth in any way since it will perceive this as a threat.

It is important to remember that judging the behaviour of wildlife can be difficult for non-experts. Should you be attacked and bitten by a fox or dog, it is likely that it is rabid. If you can kill it, you should attempt to do so, preferably before you may be bitten. It is extremely important that you consult a medical doctor as soon as possible after the incident to make sure you can be vaccinated within 48 hours.

"*Echinococcus multilocularis*", a tapeworm that occurs extensively in the northern hemisphere, has been found in mice, foxes, and dogs on Svalbard, Norway, and can infect humans. The parasite can cause serious illness resulting in death. You can become infected just by touching the droppings of infected foxes or dogs. To avoid contamination, drinking water must be boiled for minimum 3 minutes before consumption and ensure normal hand hygiene before meals.

Arctic fox hunting geese in Todalen on Svalbard, Norway (Bjørn Frantzen).

Wolves

Wolves kill and eat other animals for food, including deer, moose, beavers, and hares. Importantly though, humans are not prey and there is no documented account of any attacks from healthy wolves in the Arctic. In general, it is the wolves that will stay clear of you; they are usually very shy and it is rare to encounter them in the wild. If you do see a wolf or a pack of wolves, you can count yourself lucky.

Wolves are very curious animals and one or two individuals usually do not pose a threat. If, however, a group does come too close for comfort, gather as a team to make yourself look as large as possible, make loud noises, and fire warning shots or flares into the air. Make sure the animals have a clear escape path and the flares land in front of them, not behind them. Back away slowly while facing them and avoid making eye contact with wolves as they interpret this as challenging or threatening behaviour. Avoid showing your teeth for the same reason.

Should you stay out in wolf territory for several days, it is advisable to stay in huts or buildings or to build a campfire in the evening at your campsite, as wolves see smoke and fire as a potential danger.

Muskoxen

Muskoxen are generally peaceful animals that will not be bothered by humans. However, during mating season in fall they can become aggressive. If you come too close, they can be provoked and will behave aggressively by snorting, grunting, and scraping their horns on the ground or their forelegs. They can even attack in self-defence if they feel threatened. Make sure never to camp on their trails and to maintain a good distance (>200 m), especially if the herd has calves with them. As for all wild animals, if you are in their presence, be aware of their behaviour and movements and ensure you keep a respectable distance, even if they move towards you. If you feel you have come too close to the muskoxen, stay calm and move slowly away from the animals. If they start behaving aggressively or attack you, use your flare gun to try to scare them off. In the worst case, should this be unsuccessful and you are forced to kill a muskoxen in self-defence, make sure to shoot at the animal's upper torso area (not at its head as it may just deflect the bullet).

A muskox near Leverett Glacier, Greenland (Ruth Vingerhagen Hindshaw).

Bears

Brown and black bears

Brown bears (also known as grizzlies) occur in North America, Russia, and Scandinavia with isolated populations elsewhere in Europe. Black bears, on the other hand, are found exclusively in North America and are generally much smaller and darker in colour than brown bears.

Black bears usually live in forested areas, while brown bears can be found in both forests and on the tundra (i.e. their range extends much further northwards). Unlike polar bears, both species hibernate and you are unlikely to encounter them in winter. Both these bears are omnivores; they are eating berries, insects, roots, and bulbs of plants along with carcasses. They also eat fish and they may hunt small animals.

Brown and black bears tend to avoid humans and attacks are very rare. Bears can, however, like most other animals, be unpredictable and in some areas, precautionary measures are recommended (e.g. keeping food and cooking equipment suspended or away from tents). Consult the station website and the station manager to learn if bears are present and what precautionary measures are needed.

Polar bears

Polar bears are found throughout the Arctic and predominantly live on or near the pack ice around the coasts of the Arctic Ocean. In summer when the sea ice melts they can move further inland. This trend has been observed more and more frequently as arctic sea-ice decreases and polar bears were even observed on top of the Greenland Ice Cap.

Unlike brown and black bears, polar bears are almost exclusively carnivorous. They are feeding predominantly on seals, but also larger prey like walrus and smaller whales. In summer, climate change is forcing polar bears on land for longer periods where they may feed on e.g. eggs, fish or kelp. Being curious and opportunistic may also lead polar bears into settlements or field camps as they may be attracted to the smell of potential food sources. While some bears will shy away from people, others may display aggressive behaviour. Polar bears are inherently unpredictable and stations located in polar bear country are likely to have strict polar bear safety guidelines.

Tracks of a polar bear mother and its cub along the shore near Ny Ålesund, Svalbard, Norway. The footprints of the cub are sometimes visible inside the mother's footprints (Elenonora Conca).

You should carry binoculars, a flare gun and a rifle when you are doing fieldwork in areas where polar bears may be present. Establish a bear watch during stationary fieldwork and at your field camp (Lawrence Hislop).

Safety in bear country

The below recommendations apply to all types of bears, unless specified.

- Consult the station manager and/or locals about any recent (polar) bear sightings.
- Be aware of your surroundings and keep your eyes open for bear tracks and droppings. It is also advisable to use binoculars to keep a look out at regular intervals. Note that bears can often be difficult to spot.
- Only travel and work during daylight hours, and where possible, avoid areas with limited visibility such as high vegetation, large boulders, moraine ridges or jumbled sea-ice. Also avoid all animal carcasses.
- You may want to establish a bear watch during stationary fieldwork, particularly in areas where polar bears may be present. Trained dogs can help to detect and avert polar bears.
- In regions with polar bears, carry binoculars, deterrents, and firearms with you at all times. Keep in mind that a firearm permit may be required if you bring your own firearm.
- Consider carrying pepper spray when working in areas with brown and black bears. Keep in mind you may need a permit or it may not even be allowed.
- Make noise so that any bears will hear you well before they see you (e.g. talk or sing while walking, or consider taking a small bell with you). This means wildlife will not be surprised by your presence, and it will give them time to move away.
- Never approach a bear, particularly a mother with cubs, or an eating bear. Do not travel alone, especially if there is a good chance of encountering a bear.

Advice for safe camping in bear country:

- Before setting up your camp, look around to check whether there are tracks, droppings or any other signs that bears might have been through the area. Avoid narrow valleys, passes and, for polar bears, beaches and along coastlines. Attempt to find a spot on elevated ground with a good view of your surroundings, e.g. a small hill. Avoid camping on beaches.
- Keep your camp clean. This includes storing all garbage at least 100 m away from the rest of your camp and any water sources.

A field camp secured with a tripwire system in a remote part of Northeast Greenland (Katrine Raundrup).

- Make sure all food is in a bear-proof canister (for brown or black bears) and stored at least 100 m away from your sleeping tents (for all bears). The same is true for any strongly fragrant items, including cooking equipment and stoves, all of which should never be left in the open.
- Organise a bear watch at night. Depending on the number of people in your camp, the watch time can be 1-2 hours long, perhaps longer if needed. Having two people on bear watch is highly recommended. Consider having 30 minutes of overlap between the different watches, as this helps to keep attention up, when people are tired in the middle of the night and after a long work day. Further, you can hand over information, and the camp is guarded at all times (even during those few minutes, when the watches swap). Trained dogs can also function as bear guards.
- In darkness, night vision binoculars can be helpful.
- Consider putting up a trip-wire fence around your camp, although keep in mind that this is intended rather to wake people in the camp than to deter bears. The tripwire system shoud have an overlap at the entrance that is just wide enough for a person to pass.
- Having a bear watch is very important even when you are staying in a cabin. Do not automatically assume cabins were "bearproof" places. Be careful when exiting cabins, tents, etc., by looking around for bears.

Polar bear behaviour:

- Polar bears are naturally curious and will often investigate foreign smells or objects, particularly by biting and chewing the object. If they are just interested, the bear will move slowly with frequent stops to sniff the air, stand on its hind legs and move its head from side to side to catch the scent.
- Signs of polar bears being agitated or feeling threatened are often growling or jaw-snapping, stamping its feet, staring directly at you and lowering its head with the ears laid back.
- If polar bears are stalking or hunting, they commonly follow or encircle their subject of interest, they approach directly and unafraid, and may return after being scared away.

Polar bears are naturally curious and will often investigate foreign smells or objects (Marcos Porcires).

If you do encounter a bear:

- If you see a bear before it becomes aware of you, move away calmly and slowly. If members of your team are in the area, let them know via radio or telephone where the bear is and if it is moving in any particular direction.
- If a bear does get closer, stay calm, gather your team and try to make yourself look as big as possible by, for example, moving together as a team (to look more like one large object) or waving your arms slowly up and down. Make loud noise with whatever is available to you (e.g. cooking pots, Zarges boxes, shovels, etc.).
- If a bear gets too close, prepare to use deterrents to scare it off. Make sure the bear has a clear and obvious escape route. Use your flare gun, but make sure the flare lands in front of the approaching bear, not behind it. You may have to use several flares to deter the bear. Keep in mind that rifle warning shots rarely have a deterrent effect on polar bears and you may not have time to reload the rifle if the bear attacks. Watch the bear long enough to make sure it is leaving.
- If the bear is <30 m away and approaching, prepare to shoot lethal rounds: Aim for large muscle groups such as the shoulder and the rump. Do not aim for its head, lower limbs, or belly. Remember that shooting a bear is the very last resort and should only be done in self-defence during an attack.

3.9 Means of communication

Communication is probably the most important safety measure when working in the field in the Arctic or northern Alpine regions. You will need equipment to communicate with your team as well as with the station staff for regular safety check-ins and in case of emergency. It is important that you follow all communications procedures at the station and once out in the field. The station staff should always know where you are so that they can facilitate assistance or rescue should this be needed.

Find out what means of communication and procedures are used at the station before heading out to your field site. The station manager and staff need to be informed at all times where you and your team are (Lawrence Hislop).

3.9.1 Fieldwork plans and sign in/out boards

Stations have varying procedures, but it is likely that you will need to provide a fieldwork plan to the station staff. This may include information about where you intend to go and when, as well as who is going. This is particularly relevant when going out for longer periods or to more remote locations. The station staff may be able to provide specific relevant advice and can help check if the team is adequately prepared. Even if the station is unstaffed, it may be useful to leave such a document at the station and/or at the operating institution in case anything happens.

Many stations also have sign in/out boards, where each field team will be required to note their departure time, names of team members, where they intend to going, as well as when they expect to return. Equally important is to sign back in again once you have returned safely to the station.

3.9.2 Routine calls

When you are out in the field, you will usually need to routinely call the station to let them know that everything is going well. Each station may have particular procedures for how this is done, so make sure you have discussed this with the station staff before going out into the field. Familiarise yourself with the communication equipment and have agreed frequencies, call times and emergency contacts handy. There should be an agreed protocol for what happens if contact at the agreed contact fails.

If you are out in the field for several days or weeks at a time, the routine calls can also be useful to get updates from the station about the latest weather forecasts, sea-ice or snow conditions, polar bear sightings, etc.

3.9.3 Non-routine calls

If you need to deviate from your plan while out in the field, you may need to make a non-scheduled call to the station to inform them about any changes. This may be in relation to changing where you are going, when you are returning to the station, or if you need assistance for safety or medical reasons. Deviations from original plans might be relevant to know for either station staff or, in worse case, a Search and Rescue team.

3.9.4 Emergency calls

Should you get into an emergency situation, it is important to know who the team leader is and who will be responsible for making any emergency communication (this do not necessarily have to be the same person). There should also be a second-in-command in case it is the appointed leader who is in trouble.

It is essential that all team members are aware of who to contact and how to do so in case of any accident or emergency. Emergency procedures should be clear to all team members before going into the field and everyone should be familiar with how to use the communications equipment (radios, satellite phones, emergency beacons, etc.). Ideally, practice how to use equipment before going into the field so that you are comfortable using it even under stressful circumstances. Always have a list of emergency contact details with you and make sure that everyone in your team knows where to find it.

3.10 Safety equipment

The equipment you need to take with you will depend to some extent on what kind of fieldwork you are doing and where you will be doing it. As part of your fieldwork planning, you should have developed complete lists of all the equipment that you will require in the field, including safety equipment. No matter where you go though, you should always have enough warm clothing, food, water, a first aid kit, and means of communication and navigation with you. For longer trips, an emergency shelter such as a lightweight and windproof bivouc bag, additional independent means of communication or personal locator devices may be recommended. Depending on where you will be going, you may be required to carry a regular mobile phone, a VHF radio or a satellite phone. In areas where you may encounter wildlife, you need to bring appropriate deterrents and firearms. It is essential that you check all equipment before going into the field to make sure it is in good working order. It is equally as important to know how to use all of the equipment that you take with you into the field.

Appendix B includes various examples of equipment checklists. They may not be complete or cover all equipment, depending on what type of fieldwork you will be doing and where.

3.10.1 Communication equipment

Many INTERACT stations are located in remote regions where mobile phone coverage is either sparse or nonexistent. In general, do not expect to be able to use your mobile phone at either the station or when in the field. This means that you will need to use other communication equipment such as radios or satellite telephones. Find out from the station website or staff what equipment is required, what they have available for use at the station and what you will need to bring with you.

Communication equipment is probably the most important safety equipment to have with you when working in the field in the Arctic or northern Alpine regions. Always bring at least two independent devices when working at remote locations and know how to use them
(Morten Rasch).

Remember, communication equipment is probably the most important safety equipment to have with you when in the field. It is strongly recommended to carry two independent means of communication when working at remote locations. As for your other equipment, test it before going into the field, make sure you know how to use it and that all batteries are fully charged. In addition, you should have chargers or replacement batteries with you since cold temperatures drain batteries much faster. It is also advisable to keep whatever communications equipment you take with you in a waterproof container when not in use. Spare batteries should be kept close to the body to keep them warm.

Mobile phones
At remote arctic stations, you will rarely experience that there is mobile phone coverage. It is best to put your phone in energy saving or flight mode. In this way, you can still use it for taking photos but save power so that the battery lasts as long as possible. Walkie-talkies can be a cheap tool for communication among team members in the field, but cannot replace communication equipment required or recommended by the station.

VHF and HF radios
VHF radios are used for communication with many team members at the same time and over distances of less than about 20 km – often much less in areas with mountains or other terrain obstacles since they function generally on a 'line-of-sight' principle. Check with the station staff if VHF radios are used, if this requires any particular permits or certificates or if there are radio-silent areas. When using radios, only communicate essential messages and avoid chatter since everyone on the same channel will hear when you speak. Also remember that only one person can speak at a time on a particular channel.

HF radios were traditionally used for communication over longer distances than VHF radios but are less and less used due to the better performance of satellite telephones.

Satellite telephones
There are two different satellite telephone systems:

- INMARSAT, which works only up to about 74 °N, and
- Iridium, which works worldwide, although it is slightly less reliable than INMARSAT.

Remember to check if subscriptions are in place and valid.

InReach or SPOT
Similar to satellite phones, InReach devices are also based on satellite technology. In addition to traditional satellite phones, they can be used to exchange short text messages (which can even be pre-programmed). SPOT devices can be programmed to send out an "all ok" message with your GPS position at regular intervals. This can be particularly useful for rescue services, station staff or those back home to track the progress of your field team. Both devices also include a double function as personal locator device in case of an emergency. For both, remember to check if subscriptions are in place and valid.

Personal locator devices
There are various types of personal locator devices. Personal locator beacons (PLBs) only allow one-way communication and are used just in emergencies to send out a message with your position and to initiate a Search and Rescue operation. This can be very costly so PLB's should only be activated when in a real emergency. In some areas, though, you may be required to have one with you at all times. Again, this is something you need to find out before leaving the station.

3.10.2 Navigation equipment

When you are out in the field, always make sure that you know where you are, no matter if you are near the station on a day trip or further away on a multi-day outing. This includes bringing satellite images, maps of different scales, a compass and a GPS device. Whenever possible use landmarks for orientation and compare with your map.

HANDY TIP
Changing visibility can make it challenging to find your way back to your camp or a parked vehicle. Mark your starting position and all your fieldwork sites with a GPS point so that you will always be able to return to the same place you came from.

When you are out in the field, always make sure that you know where you are. It is a good idea to have coordinates of the stations and/or camp, field sites, and potential shelters (Morten Rasch).

Compasses point at the Magnetic North Pole, which migrates constantly and is rarely the same as the Geographic North Pole. This means that there will be a difference, measured in degrees, between the direction in which the compass needle is pointing and the direction towards the Geographic North, being the North shown on topographic maps. This is called magnetic deviation and its magnitude should be indicated on most topographic maps. Note, however, that the Magnetic North Pole is currently moving relatively fast and that this has increased influence for the magnetic deviation in polar regions. If you cannot find any up to date information on magnetic deviation or are unsure about it, it is best to ask the station staff.

3.10.3 Clothing

Staying warm and dry is essential to ensure that you can work effectively and stay safe and comfortable in the field. Even small issues can quickly become more serious in the Arctic, so it is important to take care all the time. Clothing needs to keep you warm and dry, allow free movement, be breathable (to allow perspiration to disperse, otherwise you might end up getting wet from the inside). Ideally, clothes are also lightweight and small in volume to ensure your backpack is neither bulky nor heavy.

HANDY TIP
It is useful to have multiple layers of clothing with you at all times, even if you are not always wearing them. Layering is preferable because you can then add or remove clothing during the day as temperature changes. Remember that wool and fleece continue to insulate even when wet while down and cotton do not. With typical layering you start with (1) a warm, wicking (sweat removing) layer, then (2) a warm layer or two of either fleece, wool, or down, and finally, (3) a wind- and waterproof jacket and trousers.

'Layering' is usually the best way to allow good ventilation but also to keep you warm (air between the multiple layers serves as one of the best insulators against cold). It also means that you can easily adjust how much you are wearing according to what you are doing and what the outside temperature is. Head, hands, and feet are the body parts that are most sensitive to the cold and where the cold injuries first occur. Having good head-, hand- and footwear is thus essential. It is usually advisable to have two pairs of gloves – a thin liner pair (e.g. woollen finger gloves) and a warmer outer pair (e.g. wind- and waterproof mittens). Bring also a headband or hat, and a scarf or a buff to protect your neck against cold and wind, and ideally a spare of all these.

Staying warm and dry is essential to ensure that you can work effectively and stay safe and comfortable in the field (Morten Rasch).

Depending on the terrain you will be working in, you may need to bring insulated hiking/mountain boots, steel-toed work boots or insulated rubber boots. Make sure there is enough room for either two pairs of socks or an additional insulating insole. It is important that your shoes are big enough to allow you to still wiggle your toes even when wearing two pairs of socks.

It is a good idea to test what combinations of clothing work best for you before going into the field since space will likely be limited and you will need to optimise your packing.

3.10.4 Field camp equipment

If you are going to be camping or staying in a field hut while doing your fieldwork, you will need to take additional equipment with you to ensure you stay safe and warm. This may include tents, sleeping mats, and bags, as well as cooking equipment, in addition to any food, sampling equipment, and safety equipment. It is important that you know how to use all of your equipment and ensure that it is in a good working condition, so it is a good idea to test it all before you go into the field.

If you are going to be camping or stay in a cabin while doing your fieldwork, you will need to bring additional equipment, such as tents, sleeping mats, sleeping bags, and cooking equipment with you (Nina Friis).

You may want to pay attention to your packing order. Make sure that safety equipment and items that you may need quickly (e.g. small snacks, drinking water, additional clothing, firearms and ammunition when travelling in polar bear country) are easy to unpack. You may want to have your down jacket and a small snack easily accessible, since you may get colder when stopping after a long walk, a snowmobile drive or when setting up your camp. Items that you do not need to have readily available include cooking equipment, sleeping system, food, fuel, and science equipment. Ensure waterproof packing when traveling over/across water or in seasons where rain can be expected.

HANDY TIP

Do NOT take your best laptop into the field with you. A cheap but still relatively new and well-functioning laptop is the best option for most fieldwork. Decent laptops, that are good enough for fieldwork, can be purchased for reasonable prices in most countries.

Should you be staying in the field for a longer period, it is essential that your camp is both comfortable and located in a safe place. This means that it should ideally be protected from strong wind, out of danger of rock falls and avalanches, and not in an area where flooding can occur. Think wisely about where you pitch your camp before doing so. See section 3.7.1 for further information about setting up a field camp.

Carefully consider where to put up your tent. A nice view is almost guaranteed from most camping spots, South Greenland (Katrine Raundrup).

3.10.5 Specific safety equipment

There is a number of other things that you need to take with you into the field, depending on what you are doing and where you are going. Always make sure that you have an adequate first aid kit. You may want to have one extensive kit per team, but with each team member also having their own personal smaller first aid kit.

Specific safety-related equipment that you may need:

- **General:** First aid kit in waterproof packing. Communication and navigation equipment. Hand or toe warmers can also be useful. In addition, consider bringing a windproof and lightweight emergency bivouac bag.
- **In polar bear country:** Rifle, rifle cover, flare gun, ammunition.
- **On small boats:** Life jackets/immersion suits, goggles, boots, gloves, spare parts, basic tools, extra fuel and oil, funnel, emergency flares. Your immersion suit can only offer its best protection, when it is completely zipped up and with the hood on. You may also want to prepare a grab-bag with essentials such as emergency flares, flare gun, communication and navigation tools, wind protection, torch, matches, etc.
- **When travelling in avalanche terrain:** Avalanche transceiver, shovel, and probe. Remember, it is important to carry your avalanche transceiver close to your body. Also consider a windproof and lightweight emergency bivouac bag.
- **When travelling on glaciers:** Crampons, helmet, harness, rope (minimum 30 m long and 8 mm thick), glacier rescue equipment (harness, slings, prusik cords, breaking device, locking and non-locking carabiners, ice screws, ice axe).
- **When travelling on sea-/lake ice:** Ice spikes around your neck, a safety rope (throwing lines), and a probe or drill to test ice thickness.
- **When travelling longer distances with snowmobiles:** Extra clothing, food, goggles, snowmobile repair kit (spare parts, basic tools, extra fuel and oil, cooling liquid, funnel, start cables, axe, rope) and emergency camp equipment (tent, sleeping bag and mattress, headlamp/torch stove, cooking pots, matches, fuel, cooking set, cups, cutlery, knife, emergency flares, some food and drinking powder, etc.). Note that when travelling with snowmobiles on glaciers and/or sea-ice, all safety equipment must be taken along. This means that you will most likely have to bring a sledge. The second and the last scooter share the safety equipment.

3.11 Emergency preparedness

Given the remote location of most Arctic and northern Alpine field locations, it is essential that emergency situations are taken under control as quickly as possible. It is always better to be cautious and avoid accidents happening in the first place. Proper fieldwork planning will help minimise the risk that anything goes wrong, but unfortunately cannot guarantee for entirely smooth fieldwork. Therefore, it is important to be both mentally and physically prepared for the possibility of incidents and accidents, and this includes having done a proper risk assessment and development of strategies to mitigate risks (section 1.5).

Make sure you and your team are aware of all emergency procedures at the station and when you are out in the field. Your first contact point should always be a member of the station staff, who will assess the situation and start any necessary emergency operation. If you are at the station, you may be able to talk directly with the relevant person(s), but if you are out in the field, make sure you know how to contact them. Always have a list of emergency contact details with you and make sure that everyone in your team knows where to find it.

Ensure that you have a pre-agreed leader and co-leader for all emergencies (the person may be different for different emergencies, depending on skills). These people should know beforehand what their role and responsibilities will be in the case of an emergency. For example, the person with the most first aid training should probably be responsible in a medical emergency. Appoint a co-leader who can take over if the pre-agreed leader needs help.

In addition, roles often develop naturally with the situation – some people step in and do the right thing, while others prefer to be in the background. It is important to know how you react and observe if other people can help with something – making a call, taking notes, preparing warm drinks, putting up a tent, calmly talking to an injured person, etc. However, always make sure to communicate with the person in charge.

Transport to/from some field sites may only be by means of small fixed winged aircrafts or helicopters. Exercise extreme caution and prepare your safety procedures in accordance with this. Evacuation by small aircrafts and helicopters are costly (Morgan Seag).

In case of an emergency

Should you find yourself in an emergency situation, it is important you follow the protocol agreed upon with your team and the station (this is something that should always be discussed before you go into the field). Remember to bring relevant communication equipment, emergency call frequencies/numbers, and safety protocols to the field. An example of such safety protocol is the following steps:

- Gather and organise your group. All work is put on hold until the situation is resolved. In the event of an accident, all available resources must be used to limit the extent of the accident.
- Prevent the situation from getting worse and assess causalties: Make sure the rest of the group, yourself, and the injured person cannot be harmed any further. Stabilise the potentially injured person by keeping them dry, warm and protected from wind. Evaluate if you should move away from the danger zone. Prevent any foreseeable escalations.
- Gather all basic information about the accident/emergency situation and involved person(s).
- Assess all self-help options and identify the best mitigation measures.
- Contact the station/rescue operator to get advice or plan a rescue mission.
- Keep a log of all incidents.
- Aid the rescue operation wherever possible.

All near-miss incidents or emergencies should be accurately reported to station staff, your home institution and if relevant also the police, insurance company, local municipality, etc. Information you need to deliver include date, location, time, summary of what happened, etc.

For those involved in an emergency or a near-miss incident, it is vital to undergo a debriefing to learn as much as possible from the event and to ensure that it does not occur again in the future. Be aware that any accident can result in quite serious stress for those involved, i.e. not only the person injured, but also those helping to solve the issue and in some situations, even those just watching or hearing about the episode. It is therefore always a good idea to arrange a debriefing after such an event. If, during such a debriefing, you see that someone is seriously affected by the event, it is advisable to consider offering that the person talk with a counsellor for further debriefing. It is likely that your home institution will have protocols in place for counselling support. Please check with them before going into the field.

HANDY TIP

The most important thing to know is who to contact in case anything goes wrong. Always have a list of emergency contact details with you and make sure that everyone in your team knows where to find it. It is a good idea to laminate such a list before departure to make sure that it is weatherproof. Remember that most remote stations have clear guidelines to adhere to.

CHAPTER RESOURCES

Resources related to safety and safety training:

- A good compilation of various training courses you might require can be found here: www.sstl.com
- US-APECS webinar on field safety: https://vimeo.com/131986776
- Many mountaineering clubs offer excellent outdoor first aid courses – see what is available in your country.
- A nice example of a risk assessment form: www.tcd.ie/Geography/assets/pdf/Geography%20Fieldwork%20Risk%20Assessment%20Form%202015.pdf
- A whole range of information about various aspects of safety in the field from the University Centre in Svalbard: www.unis.no/resources/hse and www.unis.no/studies/general-courses
- Health and safety advice from the UK NERC Arctic Research Station: www.arctic.ac.uk/uk-arctic-research-station/planning-your-field-season/health-and-safety
- Safety training courses offered by CH2MHill Polar Services (USA): http://cpspolar.com/for-researchers/risk-management/training
- Safety courses from Arctic Response (Canada): http://arcticresponse.ca/category/training
- Svalbard guide training courses: https://en.visitsvalbard.com/visitor-information/sgo
- Arctic Safety Centre (Longyearbyen, Svalbard, Norway): www.unis.no/resources/arctic-safety-centre
- Courses across the Arctic: www.isaaffik.org/courses
- Flow charts with recommended safety training and equipment tips from Isaaffik: www.asp-net.org/sites/default/files/website_files/Safety%20flowchart%20-%20Isaaffik%202017_V3.pdf
- Safety information about a range of different fieldwork topics: http://cpspolar.com/for-researchers/risk-management
- The Norwegian Mountain Code – some great tips about staying safe in mountainous environments: www.visitnorway.com/plan-your-trip/safety-first/in-the-mountains/the-mountain-code
- Safety on Svalbard, Norway: https://www.forskningsradet.no/prognett-ssf/Safety_in_Svalbard/1253982410622
- Working in Greenland: www.isaaffik.org/sites/default/files/arktis_manual_170313_final_til_kunet.pdf
- Safety regulations for work and residence at Tarfala Research Station in Sweden: https://www.natgeo.su.se/polopoly_fs/1.338448.1498556138!/menu/standard/file/Safety%20Regulations%20Tarfala%20Research%20Station_20170627.pdf
- Researchers working in the field in the Arctic face many challenges to health and safety. To learn from past incidents and prevent future injuries, the Arctic Sciences Section at the National Science Foundation is sharing information about accidents and near misses that have happened during fieldwork. The short summaries for each incident can be used to initiate discussions within field teams about how to better manage risks in the field: http://cpspolar.com/for-researchers/risk-management/incident-reporting/
- The National Science Foundation and CPS are focused on ways to reduce the risk to researchers working in the field. The outcome of their 2014 Arctic Field Safety Risk Management Workshop are available in the workshop report: https://commssite.files.wordpress.com/2013/09/nsf_srm_report_2015_reducedsize.pdf

- European Avalanche Warning Service:
  www.avalanches.org/eaws/en/main.php
- The Swiss Avalanche Prevention Portal:
  www.whiterisk.ch/en

Resources related to harassment and dealing with difficult situations:

- US Antarctic Program harassment policy:
  https://www.nsf.gov/geo/opp/documents/policy/Non-harassment%20Affirmation%20Policy%202018.pdf
- Bystander training:
  http://stepupprogram.org
- A training video about dealing with sexual misconduct developed by the Toolik Research Station, Alaska, USA:
  https://toolik.alaska.edu/user_guide/title_ix_training.php
- An excellent example of a code of conduct from the Toolik Field Station, Alaska, USA:
  https://toolik.alaska.edu/user_guide/policies.php
- APECS webinar on Harassment in the Field:
  https://vimeo.com/261529397
- A great resource list from the ADVANCEGeo Partnership on safety, harassment, accessibility and inclusivity in the field:
  https://serc.carleton.edu/advancegeo/resources/field_work.html
- APECS code of conduct:
  https://www.apecs.is/who-we-are/operating-procedures/2690-appendix-4-apecs-code-of-conduct.html

Resources related to staying safe around wildlife:

- A great handbook with plenty of information about how to work in polar bear country:
  http://zackenberg.dk/fileadmin/Resources/DMU/GEM/Zackenberg/pdf/polar_bears.pdf
- Reducing bear-people conflicts – a guide from the Nunavut government:
  https://gov.nu.ca/sites/default/files/bear_safety_-_reducing_bear-people_conflicts_in_nunavut_0.pdf
- A video on how to use a fence to deter polar bears from campsites:
  www.youtube.com/watch?v=3txRsJ-l5cI
- Information about staying safe in regions with polar bears:
  http://kho.unis.no/doc/Polar_bears_Svalbard.pdf
- Guidance from the local government on Svalbard:
  https://www.sysselmannen.no/en/Scientists/Guide-for-scientists-on-Svalbard/

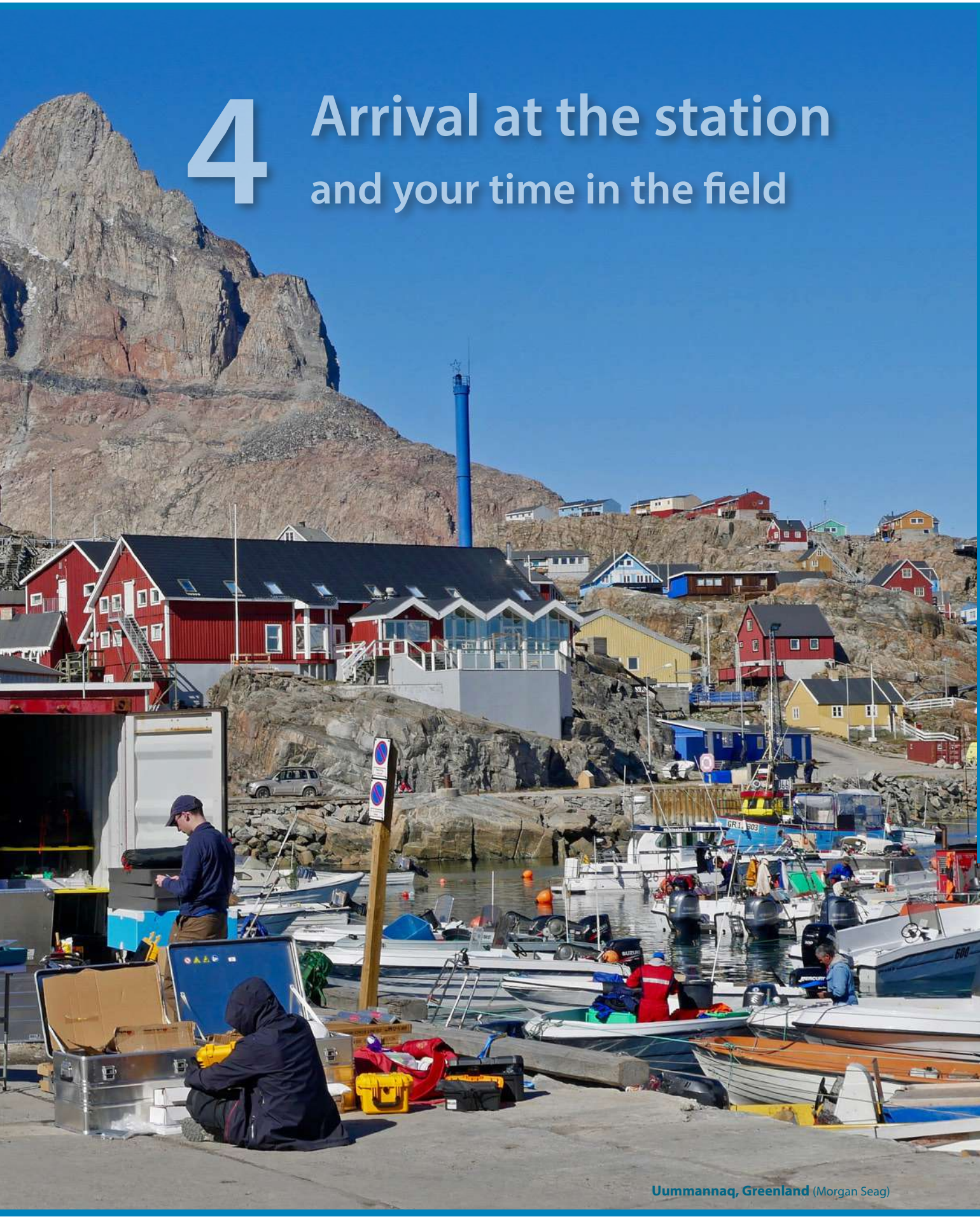
Wilderness survival resources:

- A short blog entry about the basic survival equipment you should have with you:
  http://blog.theclymb.com/tips/10-tips-for-wilderness-survival
- A website with plenty of information on various survival-related topics:
  www.twineagles.org/wilderness-survival-guide.html
- A basic wilderness survival guide from the British Columbia Adventure Network:
  www.bcadventure.com/adventure/wilderness/survival/basic.htm
- A good list of the basic survival equipment you might want to take with you:
  www.thebrokebackpacker.com/wilderness-survival

Key considerations

- When you and your team arrive at the station, take time to familiarise yourself with the station's facilities, routines, and procedures, as well as to get to know the station staff and other researchers.
- Keep detailed records and keep your field notebook in a waterproof bag.
- No matter how good your fieldwork planning is, long-lasting bad weather, delays, incidents, or conflicts may occur. Be proactive and prepared to handle them.
- Make sure your impact at the station and in the fragile arctic environment is as small as possible.
- Be open and share your knowledge and ideas with local communities and the outside world.
- Remember to allocate enough time for cleaning and packing up at the end of your stay.
- Remove installations, sticks, and other material used to mark your study sites.

4 Arrival at the station
and your time in the field



Uummannaq, Greenland (Morgan Seag)

The big day has finally arrived! After months of planning and hopefully a straightforward journey to your destination, you have arrived in the field or at the research station. But what now? This chapter covers the basics of what you need to think about while at the station and in the field. A complementary resource is the INTERACT Practical Field Guide – a handy resource that is designed to be taken into the field as a reminder of the main safety aspects and best practices.

Issues related to safety at research stations and in field camps are covered in chapter 3, since this is something you need to consider and be prepared for before arriving at the station.

4.1 Getting to know your team

Safe and successful fieldwork relies on a well-functioning team with the right skills to get the job done. Getting to know your team is essential and should, if possible, be done before going into the field. It is also helpful to find out if your team members have been to remote places, i.e. whether or not they have experience in camping or being in extreme environments. Remember, everyone may react differently to such circumstances. Doing equipment testing or safety training together is a fun way to get to know each other and builds good team spirit.

It is important to assess exactly what expertise is needed and who will be responsible for which tasks. Go through all details with your team to ensure that everyone knows what to expect to secure an efficient start of your fieldwork. Take the time to discuss who will be doing what, where and when, as well as what everyone should do if things are not progressing exactly according to the plan (because of changing weather, in an emergency situation, etc. See also chapter 3).

Safety is a major issue and all team members need to be fully aware of the risks they may face. It is essential to have a team leader as well as a co-leader and to make sure to discuss issues such as how a bear watch will be organised, if the team will take turns cooking when in the field or if there are any medical conditions of which the team should be aware.

4.2 Arrival at the station

Upon arrival, you will very likely be met by the station manager or a station staff member. They will show you around and introduce you to all procedures at the station. Familiarise yourself with the station's facilities, particularly those you will use the most, as well as station routines and procedures. Do not be afraid to ask questions if you have any doubts or need further information. Remember that the station staff are there to help you but are also likely to be busy. Taking the time to establish good relations with the staff and other researchers can make your stay a lot more fun and more productive. An open, friendly and non-competitive attitude is essential.

HANDY TIP
Even if you will be sleeping at the station, a cheap tent or an umbrella can be useful if you are taking samples which could be contaminated or damaged by rain. It also makes sampling in inclement weather much more enjoyable.

HANDY TIP
Take off your outdoor shoes when entering the station, especially in Scandinavia where this is common culture. Bringing a pair of indoor shoes will not only help to keep the station clean but you will also help you to feel more comfortable.

HANDY TIP
Small electronics such as cameras do not function as well (or at all) in extremely cold temperatures. Keep such items (or if they are too big, just the batteries) in a warm place like an interior pocket close to the body or inside your sleeping bag. This also works well for contact lenses and toothpaste.

There are many small ways in which you can minimise the impact of your work on others. For example, if you are going to be working mostly at night, try to share a room with someone working on a similar time schedule. If you have special dietary requirements, try to find somebody with whom you can share cooking.

In general, respect the quiet hours of the station as well as personal space, and avoid taking up internet bandwidth by downloading a movie for a period with particularly bad weather. Preparing a hard drive with music and movies before going into the field for a long time can be a good idea. Remember to pack and use your headphones.

Take the time to establish good relations with the staff and other researchers. You might even be lucky to find someone whose experience or data may contribute to your project and vice versa (Katrine Raundrup).

4.3 Working at field sites

If you are staying at field sites away from the station, either for a day or several days, ensure you follow all station protocols in relation to being in the field. This may include, for example, providing an itinerary (see section 3.9), establishing regular radio check-ins and/or completing sign in/out forms.

Discuss your fieldwork plan and daily work plans with your team and the station staff before heading into the field. Make sure that each team member is aware of all safety and emergency procedures as well as their specific work tasks. Also make sure to go over any sampling regulations related to the work you will be doing, as well as general environmental awareness to ensure your team makes minimal impact.

HANDY TIP

Maintain a field notebook. Use a pencil and keep it in a waterproof bag. Record daily weather and other environmental conditions or disturbances that may impact your data. Do not assume you will be able to remember everything when you get home. In the field you often lose track of time because each day is similar, due to the polar day/night and because it is quite usual to work seven days per week whilst at a research station. Having a notebook to refer to when you return home can help to reconstruct events, small things that might impact measurements, etc.

Fieldwork can be a pleasure when sampling is easy and you all know exactly what to do in relation to both science and safety (Morten Rasch).

Keep in mind the following advice when you are in the field:

- Do not go to your field site or travel alone if you work at remote field sites or in challenging terrain.
- Getting GPS-positions of all your fieldwork sites is important for your work, and it is often relevant or mandatory for the station afterwards.
- Safety always takes precedence over the completion of your project. Do not put yourself or anyone else in your team at risk to obtain samples.
- Changes in the weather will mean that you need to be flexible and able to adapt plans at short notice.
- Keep an eye on weather updates in order to be prepared to use favourable conditions, even if it means working at unconventional times.
- Practise patience and tolerance with your team, especially in difficult or uncomfortable circumstances.
- Remember to rest. It is easy to spend extensive time out in the field and work long days. Exhaustion can lead to unsound judgement, unnecessary risks, and accidents. It is better to keep a good balance between work and rest and ensure you have enough energy even at the end of your time in the field. This is very important – but not always easy.

It is of particular importance to describe and geo-reference extractive activities and manipulation studies that may impact future science in the area (e.g. adding nutrients, artificial warming, snow removal, soil sampling, specimen sampling, etc.). Such studies should only be done with permission from the station (and relevant authorities) and the exact location and precise description of what has been done should be communicated to the station when fieldwork is over.

Long term stays or repeated stays over a number of years in the same area can impact the local environment by e.g. damaging vegetation or changing local soil properties that may lead to erosion. Shifting tent location periodically or between years may minimise impacts of repeated or prolonged use of specific

See chapter 3 regarding risks and safety while in the field and at the station.

4.4 In case something does not go according to plan

No matter how good your fieldwork planning is, delays still can happen and bad weather can severely hamper field operations.

Weather in the Arctic and northern Alpine regions can be severe and change quickly. If you are out in the field you need to know how to judge when weather is getting worse and when to pack up and retreat. Furthermore, you need to have adequate equipment to survive a few days in a tent if you cannot get back to the station. Ensure your fieldwork plan allows for extra 'bad weather' days and be prepared to work at unusual times to take advantage of any good weather windows. This is particularly relevant in the Arctic where you most often will experience 24-hour daylight during summer fieldwork. Remember to communicate delays to the station or other people expecting you back earlier (see section 3.9.3 on non-routine calls).

Multiple flights may be needed to bring all people and equipment to the field site or camp site. The first group to arrive should have enough food, fuel, and gear (including communication, navigation, and safety equipment) to survive several days in case no further flights are possible.

HANDY TIP

When you are out in the field, keeping a positive attitude can help you surmount many of the challenges you may meet and will generally help you to enjoy your time out in the field. Creating a good and happy atmosphere can do wonders for you, your team and how much you will be able to get done. Do not be afraid to be a leader even if this is not directly your role; a positive attitude is contagious and you can thus help spread the "good vibe". Remember, it is a privilege to go into the field – an opportunity that only very few people on this planet have – so enjoy the experience.

Be prepared to work at unusual times to take advantage of any good weather conditions and the 24-hour daylight of the arctic summer (Morgan Seag).

4.4.1 Handling delays

It is essential to have the contact details of all those involved in the transport and delivery of equipment to the station, whether it be a company or a person at your institute involved with logistics or import/export. You need to know who to call if your gear is stuck in customs or has not arrived. Such delays can cause unnecessary stress and reduce the number of days you have available in the field so it is essential that you know who to contact immediately and have the means to do so (computer with internet access, functioning telephone, etc.) in case something does not go according to plan.

Fieldwork in the Arctic may include a lot of cargo for logistics and field equipment. Prepare transport of goods and relevant permits well in advance to avoid delays (Morgan Seag).

HANDY TIP

Depending on what your fieldwork entails, you may be able to bring a basic sampling kit in your hand luggage in case there are delays with delivery of checked-in or shipped luggage. This means that you can start sampling/measuring without having to wait for equipment that arrives late. Remember that you may be restricted by airline and government policies: it is standard in most countries that knives, scissors, and liquids/gels of more than 100 ml are not allowed in hand luggage on board aircraft.

4.4.2 Handling conflicts

Being in close confines with a small team of people and often under extreme circumstances may lead to small or large conflicts. An important aspect of fieldwork is that your entire team is mentally prepared for high-pressure situations and that all team members are friendly and considerate at all times. Before going into the field, you may therefore want to discuss responsibilities and expectations to minimise misunderstandings and confrontations. You may also want to devise a routine time (for example at dinner) to raise and overcome any issues in an open and friendly way before they develop further.

HANDY TIP
Bystander training can be useful for all team members. This involves learning to step in at the right time when you see that a situation or conflict, often psychological, may be developing.

HANDY TIP

You are extremely lucky to get the chance to work in a remote and beautiful environment such as the Arctic or northern Alpine regions. Approaching your fieldwork with an optimistic and cheerful attitude will help you and your entire team to have a positive and memorable experience. Remember to get enough rest during your fieldwork and to ensure that nobody in your team gets exhausted. Being under stress or sleep-deprived can more easily result in anger and conflict building up.

Conflicts are generally rare, but should one arise it is important to be prepared. Make sure that team members feel they have a safe and secure environment to discuss any issues, possibly with a predefined person as the mediator with decision-making power. Anyone in such a role should exercise the highest level of integrity and confidentiality when dealing with any situations that occur.

Steps to take in a conflict include: (1) ensuring the situation does not deteriorate, (2) gathering information from all involved parties, and (3) communicating any decisions to everyone involved (the mediator should be the one doing so). External experts (e.g. a counsellor) may be contacted to get advice, particularly in the case of possible mental health problems.

Following any conflict, it is vital that all involved parties undergo a debriefing so that they know why and how particular decisions were made and how similar situations can be avoided in the future. This is an essential step in the learning process and helps to restore a good living and working atmosphere.

4.4.3 Harassment and discrimination

Harassment, discrimination, and workplace violence are not tolerated in any project involving INTERACT or APECS. Team leaders and team members must work together to ensure a safe and welcoming environment for all.

Harassment includes any distressing and unwelcome verbal comments, gestures, or conduct targeted toward an individual on the basis of sex, sexual orientation, gender identity, race, ethnicity, religion, disability, physical appearance, age, or other group affiliation. Workplace violence includes any verbal or behavioural activity, which can reasonably be interpreted as a threat that could cause physical or mental injury, as well as any attempt to exercise direct physical harm. No violence or harassment should be tolerated in any workplace, neither in the field. The same is true for discrimination, which can be defined as any action that denies a person's rights based on their race, religion, ethnicity, sexual orientation, age, disability, or any other social affiliation.

Team leaders need to set a clear code of conduct for fieldwork. This should be in written format and sent to all team members before being discussed openly with the entire team. It is essential that a positive, safe, and comfortable work environment is created for everyone. Having clear guidelines about what constitutes harassment and discrimination and stating that this will absolutely not be tolerated, is an important step towards avoiding such episodes. Most universities, research institutes, and field stations have harassment and discrimination policies and you should make yourself and your team familiar with them.

If at any point you feel that somebody is behaving inappropriately, regardless of organisational affiliation or hierarchical status, speak up! Report issues as soon as safely possible to your team leader, station manager, principal investigator, human resources, or any other appropriate person. You always have a place to turn and every right to point out any harassment or discrimination of any kind.

4.5 Environmental considerations

In all your fieldwork activities you should aim to reduce environmental impact to a minimum. As a scientist, it is your responsibility to take care of the fragile environment you are working in and this should be an inherent part of your approach to working in the field. You should also be familiar with the relevant laws and regulations governing the area that you are visiting; know if there are particular rules regarding protected areas, etc. and if there are specific station guidelines to follow (e.g. regarding field experiments, extractive sampling, wildlife handling, addition of nutrients, use of chemicals in the field, establishing field installations, etc.).

Along with environmental considerations, paying attention to cultural heritage is important. Generally, all cultural remains are protected by law. Cultural heritage sites should not be disturbed in any way unless you have a permit to study them. Such locations deserve to be approached with respect during visits and should remain unchanged when you are leaving as they may still be of importance to the local communities or of scientific interest. The station staff will help to ensure that your activities and chosen field site will not interfere with local heritage sites. In addition, they may be able to recommend places worth visiting to familiarise yourself with local cultural history and traditions.

In all your fieldwork activities you should aim to keep the environmental impact at a minimum. As a scientist, it is your responsibility to take care of the environment you are working in, and this should be an inherent part of your approach to working in the field. This is especially true in the fragile Arctic and high Alpine regions (Nina Friis).

4.5.1 Pollution prevention

The Arctic and northern Alpine regions are extremely sensitive environments and it is therefore essential to prevent any pollution and reduce the amount of waste produced to a minimum. Do not pollute any waterways (lakes, streams, etc.) in any way, including by urinating. Just like anywhere else in the world, never drop any litter, including cigarette butts, and pick up any litter that you come across in the field or around the station.

Reduce the possibility of pollutant spills in the field and workspaces by using appropriate spill kits or secondary containers. However, if any pollutant spill occurs, make sure it is reported immediately, regardless of the volume spilled. Clean up the spill to the greatest extent possible.

4.5.2 Waste management

Think about how you can reduce the amount of waste you produce before, during, and after you are in the field. For example, remove as much packaging as possible before going into the field, especially light plastic materials that might fly away in windy conditions, and use rechargeable batteries wherever possible. Never leave scientific instruments or camp equipment in the field. Use environmentally-friendly toiletries, i.e. products that do not contain any harsh chemicals or micro-plastics. Any waste produced while you are in the field will need to be packed and brought back to the station, where it should be sorted for recycling, storage or disposal according to station procedures. This may include human waste. At most stations, it is prohibited to burn or bury any waste.

Particular attention should be paid to hazardous materials, which need to be appropriately packaged and labelled. Consult the station staff if you have any doubts about what you need to do with any of your waste.

4.5.3 Reducing energy use

Many stations are reliant on burning fossil fuels to provide heating and electricity. Reducing the amount of energy needed can help reduce emissions and is the responsibility of everyone at the station.

Small and simple measures can help reduce the amount of electricity that needs to be produced, as well as how much water and waste need to be treated. These measures include:

- Switching off lights and all equipment, including computers, when not in use.
- Unplugging chargers of computers and equipment when not in use.
- Regulate the temperatures in your bedroom and living spaces to recommended levels (e.g. 18 °C for bedrooms and 20 °C for living rooms).
- Ensure that radiators and other heaters are not blocked by clothing or furniture.
- If possible, ensure that all equipment is as energy efficient as possible and used only when necessary.
- Make sure refrigerators and freezers are set at the right temperature, not too cold, and remember to only open them quickly.
- Take only brief showers (if there are any at the station).
- Do not leave taps running.
- Report any leaks in water systems immediately, no matter how small.
- Think about renewable power sources for your instruments before going into the field.

Always respect the fragile flora and fauna around you, keeping a safe distance from wild animals and not picking up any rocks, vegetation, or other specimens unless it is part of your fieldwork and you have a permit to do so. Arctic hare, Disko Island, Greenland (Ruth Vingerhagen Hindshaw).

4.5.4 Respect protected areas, fauna, and flora

Many stations are located in or close to protected areas, which may have various restrictions and regulations in place. Make sure you and your team are aware of where these areas are located, that you have the correct permit to enter them and that you are aware of the particular conditions of the permit.

Do not interfere with any wildlife. In general, it is advised to maintain a distance of at least 200 m. If an animal appears disturbed, you should immediately increase the distance by walking slowly away (see section 3.8.7). Do not remove any plants, geological specimens or artefacts from historical sites unless you have a permit to do so. Do not build cairns or modify the environment in any way that is not an approved part of your fieldwork.

4.6 Working with local communities

As interest in the Arctic grows and more and more researchers make their way to the region to conduct fieldwork, it is becoming ever more important to engage successfully and respectfully with local communities. There are several key aspects that researchers must be aware of when conducting research in the Arctic, even if their research does not directly involve humans. All researchers, scientists, and explorers who visit the Arctic have a responsibility to ensure that their visits do not harm local communities. Part of this responsibility includes respect for local communities, local knowledge and research practices/protocols, as well as reciprocity in the benefits of the research. As a researcher, you need to be aware of the governing structures that exist in the area in which you will be working and you need to seek approval to conduct research before you travel to the area.

Building trust takes time but is arguably the most worthwhile pursuit to keep in mind. Researchers should plan extra time into their field seasons to include community collaborative work (see section 2.4). It is recommended that you make the time to arrive in communities before beginning your research to get to know them and share ideas. Showing that you have good intentions and that you want to listen can encourage successful collaboration with local communities no matter where you are. It is also critical to clearly indicate that you will report back and share your results after your research has been completed.

Working with local communities can be a valuable experience for all involved and you will undoubtedly learn a lot. Interactions with all people should always be based on three fundamental values: respect, equity, and reciprocity. Aasiaat, Greenland (Ruth Vingerhagen Hindshaw).

You may want to consider asking colleagues who have worked in the area if they have personal contacts you could get in touch with. You could ask the station manager for contacts since they very likely have good links with local communities and can help you connect with the right people. They can also inform you about any necessary permits, licences, and procedures you will need to obtain from local communities to carry out your research (see also section 2.3). In all cases, the most important thing to keep in mind is that any interaction with all other people (local, indigenous or otherwise) should be based on three fundamental values: respect, equity, and reciprocity. Also be aware that in some areas or at certain times of the year (e.g. during the hunting season), locals in the Arctic can be very busy doing other things or for other reasons may not be very interested in having contact with other people coming to the area to spend a short period in the community. Show empathy when you first meet any local people, and, quite obviously, a high level of respect, particularly if they want to have privacy.

Stations may have developed cooperation agreements with local communities, so asking the station manager for advice on how to interact with the local community can help you find out how to work with them. Involving communities in your research also provides an opportunity to expand your sampling season or obtain local knowledge of scientific interest.

4.7 Communication with the outside world

As part of your project, you may have planned to write a blog or share your field experiences through social media. These are both excellent ways to communicate your science directly to the wider public but make sure that you are aware of any regulations related to this type of communication; either at the station or at your home institution. You may want to see whether your institution has any recommendations or best practice documents for how to do this most effectively.

Internet connections are often slow at arctic field stations and the connection may have difficulties in handling heavy files. Consult the website prior to departure or ask the station manager what you can expect at the station. An alternative can be e.g. weekly letters with some photos (consider compressing their format) that are sent out as a pdf document. In this case, we recommend compiling a mailing list beforehand. Also remember that not all of your companions in the field may be happy to appear in either pictures or blogs on the internet. It is important to ask them before you post anything.

Another important aspect to keep in mind is how to communicate with the outside world (e.g. on social media, etc.) about disruptions and distractions during fieldwork and consider carefully what information is confidential. Contact the station manager or staff about established routines and carefully assess what information needs to remain confidential. In case of an emergency, it is essential that communication channels, e.g. radio or satellite phones, are open for potential rescue operations.

Make sure to allocate enough time to pack up the field site (Ruth Vingerhagen Hindshaw).

4.8 Leaving the field

Remember to remove installations, sticks, and other material used to mark your study sites after your project has finished. If you will return to the same site later, mark its position using your GPS.

Bring out all equipment that are not part of continued measurements or markings. Leave the area as close to the state it had when you arrived and bring out all garbage and dispose this at the station or local handling facilities.

Make sure to plan enough time (depending on the complexity of your research operation, e.g. one day) to properly pack up and clean all your equipment and samples, tie up loose ends, ship any cargo, and prepare for departure. This is something that should not be underestimated! All samples should be clearly labelled with your name and any other numbering necessary as specified by your project and/or the station. Samples that are to be transported back home need to be packed appropriately, e.g. to remain frozen, not to break or leak, etc. Check through all equipment lists to ensure that you have packed everything that you brought with you to the station.

HANDY TIP
When packing up, consult your packaging lists and photos taken prior to the field visit to ensure that you bring all your items home with you.

CHAPTER RESOURCES

Websites with information about science communication advice on using social media:

- How to use social media for science
  www.elsevier.com/connect/how-to-use-social-media-for-science
- More information about using social media:
  www.fromthelabbench.com/from-the-lab-bench-science-blog/2017/1/15/3-secrets-to-social-media-for-science-communication
- APECS webinar on an example fieldwork outreach project 'Follow-A-Researcher':
  https://vimeo.com/165873221
- APECS webinar on using strategic science communication:
  https://vimeo.com/164386526
- US APECS blog post on "Balancing Act: How to maintain a positive public blogging presence whilst encountering challenges in the field":
  http://usapecs.wixsite.com/usapecs/single-post/2018/07/31/Balancing-Act-How-to-maintain-a-positive-public-blogging-presence-whilst-encountering-challenges-in-the-field

Information about dealing with human waste:

- The Scottish Mountaineering Council has some great info about 'Where to go' in the outdoors:
  www.mountaineering.scot/assets/contentfiles/pdf/where-to-go-leaflet.pdf

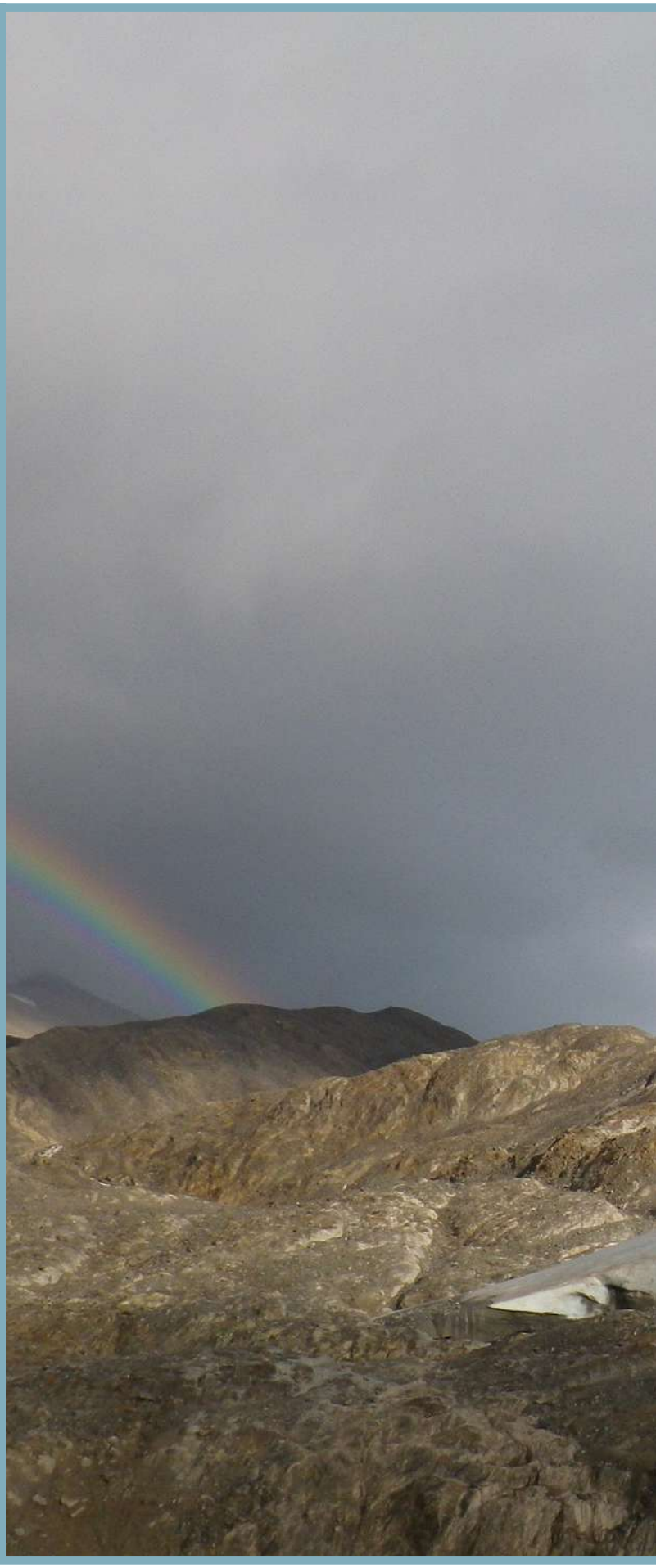
Information about working with local communities:

- Scientific research in the Arctic necessitates good communication and cooperation with northern communities. The Arctic Research Consortium of the United States (ARCUS) has compiled resources, recommendations and "best practices" from a variety of organizations:
  https://www.arcus.org/resources/northern-communities
  If you have specific questions and cannot find an answer among the material, you may contact Lisa Sheffield Guy (lisa@arcus.org) or Helen Wiggins (helen@arcus.org).
- The Responsible conduct of Research by NSF:
  https://www.nsf.gov/bfa/dias/policy/rcr.jsp
- Canadian Institute for Health Research: Guidelines for Health Research Involving Aboriginal Peoples:
  http://www.cihr-irsc.gc.ca/e/29134.html
- Tri-Council Policy Statement for Research Involving Humans: Research Involving First Nations, Inuit, Métis:
  http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter9-chapitre9/
- Toolbox of Principles for Research in Indigenous Contexts: Ethics, Respect, Equity, Reciprocity, Cooperation and Culture.
  http://www.cssspnql.com/docs/default-source/centre-de-documentation/toolbox_research_principles_aboriginal_context_eng16C3D3AF4B658E221564CE39.pdf
- Member organisations of the Saami Council, the cooperation organization of the Saami organizations in Finland, Sweden, Norway and the Russian Federation:
  http://www.saamicouncil.net/en/organization/miellahttosearvvit/
- APECS webinars:
  From the Nordic project:
  https://www.apecs.is/research/apecs-projects/past-projects/3017-apecs-nordic-project.html
- Panel discussion on working in collaboration with communities and the role of traditional knowledge:
  https://vimeo.com/209783285
- Working with Northern communities from the perspective of a grad student and post-doc:
  https://vimeo.com/258812715

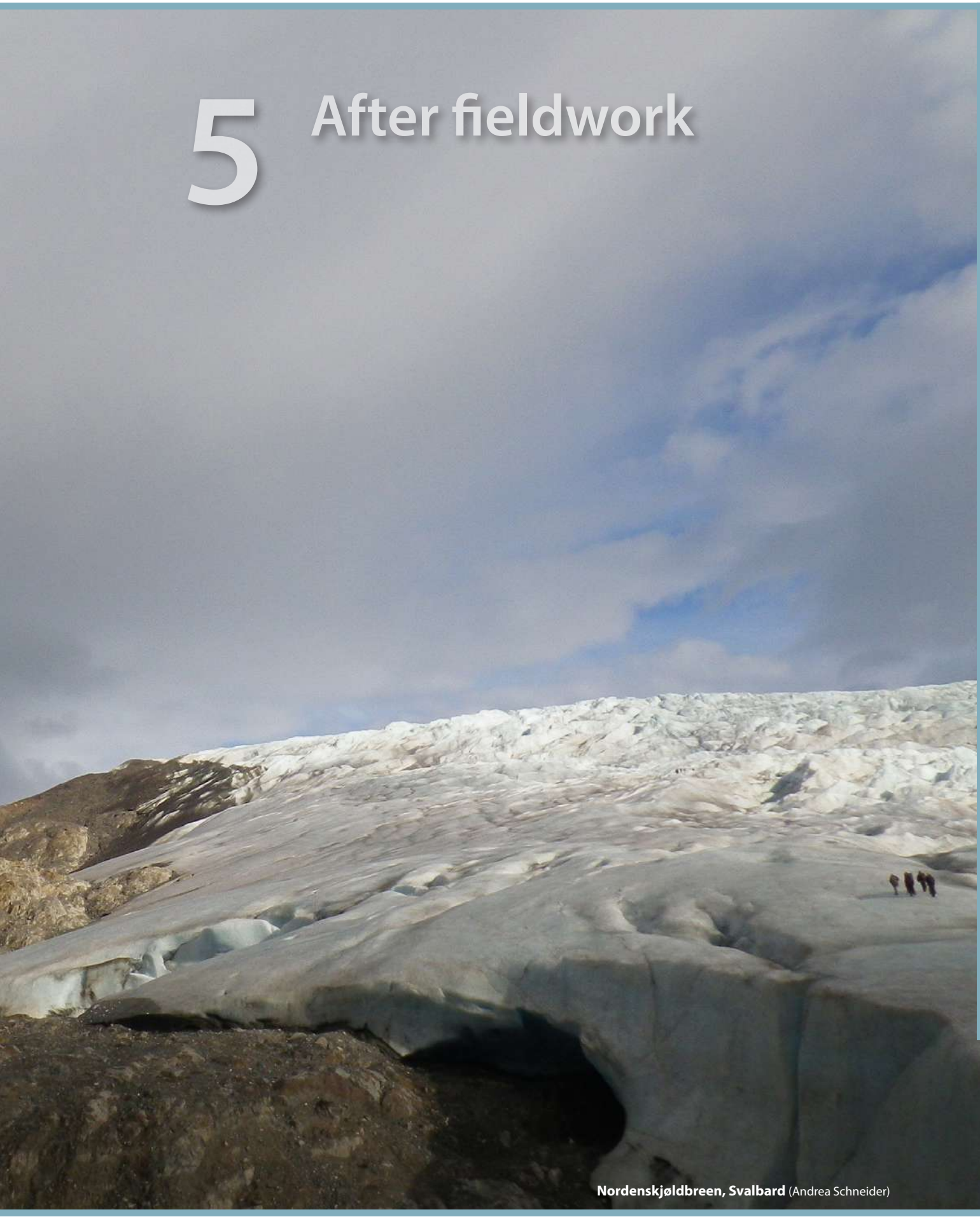
Key considerations

- When returning home after your fieldwork the first important aspect to keep track of is distributing summaries of your fieldwork to the station, funding agencies, local communities, social media outlets, etc. and making a field report with sample lists.

- A second important aspect is to ensure proper archiving and preservation of data, metadata, and samples in relevant archives, and to make data backups where relevant.



5 After fieldwork



Nordenskjøldbreen, Svalbard (Andrea Schneider)

Once you are back from the field, there may be several things to wrap up. Make sure you plan enough time for all the work that follows once you return home. This includes the necessary paperwork (for example, reimbursement for your travel), providing summaries of your preliminary research results to be sent to communities, funders, the press, etc. and any other logistical work (e.g. receiving and unpacking equipment) in addition to the time you will need for analyses, data processing, and data preservation. Having a fieldwork report and sample lists can help other interested researchers to collaborate with you since you can show them directly what you have done, where, and when long before you publish your papers.

5.1 Reporting to the station, funders, and local communities

Some stations requires a field report to be submitted immediately after field work. Make a short report stating what you did during your fieldwork, including any relevant discovery metadata. This should preferably be done before leaving the station, but at least no later than one month after your fieldwork. Something similar may be posted as part of your outreach activities using social media, your blog, etc.

Depending on how your project was financed, you may need to submit reports to the funding agency that supported your work. Make sure that you are aware of all obligations as well as any deadlines for reporting. Starting this reporting early will help ensure you can easily remember everything and that you meet the relevant deadlines.

When returning from fieldwork, you still have all the memories of breath taking moments. Share these and your data (Rodolphe Merceron).

HANDY TIP
Reports to funders are often due many months (sometimes years) before you write your scientific papers. Keep a note of your login details for accessing the funding platform so that you can add the details of your papers once they are published. It is also very important that you remember to add an expression of gratitude to the funder (at the very least a grant code) in the acknowledgements of any papers you publish based on the funding you received.

Plain language summaries of your work can be sent to local communities, the press, your university, etc. Many local communities also have social media profiles, local grocery stores with bulletin boards and radio stations that can help disseminate your results. You might also ask the station manager how you can most efficiently share your results with the local public.

HANDY TIP
It is very important to acknowledge the station you visited in any publications that result from the work that you carried out there and to send them the final paper.

5.2 Data preservation, backup, and submission

Your data management plan should outline how and where you are going to preserve your data and in what format, once you have ensured that they are of good quality. Make sure you allocate enough time to collect and provide the required metadata and to submit all data to the relevant archive(s). While this can sometimes feel like a bit of a boring task, it is an essential one that will add your data to the common data pool and is something that more and more stations and funders require.

Make sure your physical samples are metadata catalogued and properly preserved in the relevant institutional and/or national data centres. This is normally the responsibility of the principal investigator of a project. Access to physical samples should be made available according to the rules and regulations set by the station, your home institutions, funding agency, etc. For a list with examples of various data and metadata repositories, see section 1.8.

Appendices

Zackenberg, Northeast Greenland (Jakob Abermann)

APPENDIX A: Checklists

This appendix provides a list of questions you may want to ask the station manager/staff if you cannot find the information on the station website or if you are in doubt about anything. Note that this list is by no means complete, there may be many other things you want to find out, particularly before going to the station.

Before going to the station

Defining your aims and objectives:

- Have similar research projects been carried out in the past?
- What data are available and if so from where?
- What particular environmental features might be relevant to your research?
- What are the local conditions like (possibly for a particular time of year)?
- Are there particular species distributions you should be aware of?

Permitting issues:

- How do you apply to get access to the station?
- What permits, licences, and visas are necessary to go to the station/fieldwork areas?
- Are there environmental compliance regulations that you need to be aware of?
- What import/export permits will you need to take your equipment and samples in/out of the countries you will be visiting/travelling through?
- What medical information is required by the station?

Safety considerations:

- What safety training is necessary to perform your specific fieldwork?
  Should the relevant safety training be completed beforehand, or can it be done at the station?
- What safety equipment is compulsory and what is recommended?
- What safety equipment do you need to bring yourself and what is already available at the station?
- Do you need a special insurance to cover emergency response/SAR operations?

Logistics:

- How do you get to the station (your team and equipment)?
- What transportation is available to field sites?
- What laboratory and workshop facilities are available at the station?
- What kind of storage is available for samples in the field and at the station?
- What electricity is available at the station?
- What kind of internet is available at the station? Does it cost anything?
- What means of communication are available at the station and for use in the field?
- Does the station have contacts in the local community who you could get in touch with to discuss your research plans?
- What is the best way to share your results with the local public?

At the station

General questions for stays at the station:

- What are the daily routines of the station (eating hours, electricity, water consumption/ showering/laundry, quiet hours at night etc.)
- How can you help at the station? (e.g. cooking, cleaning, etc.)
- How is waste handled at the station?
- What procedures and guidelines exist for internet usage?

Science related questions:

- Are there any field sites/camp sites they would recommend for your research aims?
- Where can you find relevant equipment, laboratories, workshop, etc.
- Who can introduce you to relevant local community representatives?

General safety related questions:

- What are the station's safety procedures?
- Are there sign in/out boards and how should they be completed?
- What is the communication routine for when you are out in the field (i.e. how frequently do you need to report back to the station)?
- What are the procedures that should be followed if an emergency occurs?
- How do you report an emergency or a near-miss incident?

Safety questions to ask before going out:

- What is the weather forecast for the coming days?
- What are the snow/sea-ice/etc. conditions like?
- Are there particular areas to watch out for (e.g. that are prone to rock/snow avalanches)?
- Are there any particular local weather phenomena, you should be aware of (e.g. any special cloud formations that warn of an incoming storm)?

APPENDIX B: Equipment lists

This appendix includes various examples of equipment checklists. They may not be complete or cover all equipment, depending on what type of fieldwork you will be doing and where.

Personal equipment

Clothing and footwear:

Long thermal underwear (wool, silk or synthetic)	2-3
T-shirts, long-sleeve top	2-3
Underwear	5 or more
Light socks (for at the station/travelling)	5 pairs
Hiking socks (wool and thick)	2-3 pairs
Pyjamas	1
Fleece or similar mid-layers (thin and thick)	2
Down or synthetic jacket (winter/high-altitude jacket)	1
Wind- and waterproof jacket and pants (Goretex or similar)	1
Warm and waterproof boots (and extra laces)	1-2 pairs
Sneakers (nice to have at the station/camp)	1 pair
Indoor shoes (slippers or clogs)	1 pair
Liner gloves	2-3 pairs
Warm outer gloves/mittens	1 pair
Warm hat	2 or more
Sun hat with brim	
Face mask (if applicable)	

Miscellaneous:

- Backpack with rain cover
- Whistle
- Data storage device (for harvesting data from field equipment)
- Personal toiletries (including any necessary medication)
- Sunscreen and lip protection
- Sunglasses (more than one pair)
- Glasses/contact lenses (if applicable – also more than one pair)
- Lightweight towel
- Knife/Multitool
- Alarm clock
- Reading material
- Camera with extra batteries/charger
- Headlamp/torch with extra batteries/charger (depending on the season)
- Water bottle
- Notebook (possibly water-resistant)
- Pens and pencils

Field equipment

- Tent
- Sleeping bag(s)
- Sleeping mat(s)
- First aid kit
- Stove
- Fuel bottle, filled
- Cooking pot(s) and lid(s)
- Eating and drinking containers
- Cutlery
- Lighter/matches (waterproof packing)
- Emergency rations

Safety equipment

General safety equipment:

- First aid kit in waterproof packing
- Windproof and lightweight emergency bivouac bag (if relevant)
- Firearms and pyrotechnics (if relevant)

Communication equipment:

- Mobile phone
- VHF/HF radio
- Satellite phone
- InReach or SPOT
- Personal Locator Beacon (if relevant)
- Spare batteries and/or chargers

Navigation equipment:

- Map(s)/satellite images, even when you have e.g. a GPS. The GPS might stop working.
- Compass
- GPS
- InReach or SPOT
- Spare batteries and/or chargers

Basic First Aid Kit:

- 2 latex surgical gloves
- 1 mouth to mouth resuscitation face shield
- 1 scissors
- 2 triangular bandages
- 2 wound dressings
- Sterile gauze
- Roll of adhesive surgical tape or steri-strips
- Small selection of plasters
- Packet of dextrose sweets
- Painkillers (e.g. ibuprofen and paracetamol)
- Antihistamine tablets
- Pencil and paper
- Survival blanket

Specific safety-related equipment that you may need:

When using small boats:

- Life jacket and/or immersion/survival suit
- Goggles, boots, and gloves
- Spare parts and basic tools for repair of the engine and boat, extra fuel and oil, funnel
- Emergency flares
- If relevant, a waterproof grab-bag for storage of safety equipment

When using snowmobiles:

- Helmet, goggles, gloves, sturdy boots, and warm clothing
- Extra clothing, spare goggles, and gloves
- Sufficient food and drinks
- Snowmobile repair kit: basic tools, spare parts, extra fuel and oil, cooling liquid, funnel, start cables, axe, rope
- Ice spikes (when travelling across sea-ice or frozen lakes and rivers)
- Crevasse rescue equipment (when travelling across glaciers)
- Avalanche transceiver and rescue equipment (when travelling through avalanche terrain)
- Camp equipment when travelling long distances

When doing glacier fieldwork:

- Ice axe
- Crampons
- Harness
- Rope
- Helmet
- Gloves
- Avalanche probe
- Crevasse rescue kit (this may vary, depending on the rescue technique you are familiar with)

When travelling in avalanche terrain:

- Avalanche transceiver, worn on the body and switched on
- Avalanche probe
- Snow shovel (metal)

When travelling on sea-, lake, or river ice:

- Ice-spikes (always around your neck)
- Probe or drill to test ice thickness
- Rope

In polar bear country:

- Binoculars
- Polar bear deterrents: flare gun/signal pistol, pyrotechnics, noisemakers
- Weapons for self defense: rifle and ammunition
- Tripwire systems (if relevant)

APPENDIX C: Health risks

This appendix outlines a few of the main health risks you may face when out in the field; but is by no means a comprehensive first aid guide. The INTERACT Practical Field Guide also provides a brief overview of the basics of first aid, but neither is a substitute for proper training.

Fatigue

Fatigue, or the lack of energy and motivation, can be an issue when out in the field, particularly after several days or weeks under strenuous conditions. While fatigue in itself is not dangerous, the lack of concentration or physical weakness associated with it can lead to accidents. Reducing activity levels as well as eating and sleeping enough are essential to ensure that you do not become too fatigued (a certain level of tiredness is, of course, quite normal). If any of your team members seems to be pushing themselves too hard, make sure you communicate openly with them and remind them that this is how most accidents happen.

Hypothermia

In the Arctic and northern Alpine regions, hypothermia is a real risk, particularly in winter. It is defined as an internal body temperature of less than 35 °C (95 °F) and progressively affects a person's cognitive and physical abilities. Hypothermia is a medical emergency but if treated quickly and appropriately, recovery can be complete with no consequences.

Factors that affect the risk of hypothermia include:

- Not dressing appropriately for cold weather.
- Inadequate nutrition (i.e. not eating enough calories to stay warm, drinking too little).
- Partial or complete immersion in cold water.
- Certain medications.
- Young and elderly people (their bodies do not regulate temperature as efficiently).

Symptoms of hypothermia depend on the severity, starting with mild hypothermia including shivering, fatigue, an increased respiratory rate, mild confusion, and some difficulty with speech or coordination. Symptoms of moderate hypothermia are similar but stronger, while in cases of severe hypothermia shivering stops, confusion can be extreme (including, for example, removing clothing), breathing can become slow and shallow and coma can result in death.

Prevention of hypothermia is simple:

- Make sure you are properly dressed (using several layers that can be added/removed, including wind- and water-proof layers).
- Stay dry (keep in mind that wool base layers are safer than cotton, which can become wet with perspiration and will be more difficult to heat up again).
- Remain well hydrated (and ensure you go to the toilet often enough).
- Ensure you have the right nutrition.
- Stay in good physical shape (fatigue can affect your ability to stay warm).

If you see signs of hypothermia, it is important to start treating the person as rapidly as possible, but keep in mind that if hypothermia is moderate or severe, the person needs to be warmed up slowly. This means carefully bringing their body temperature back to normal. Do this by removing any wet clothing, prevent further heat loss and protect the person from wind. In severe cases, use what you have to wrap a person according to the so-called "Hiblers method":

- Remove any wet clothing.
- Place a reflective sheet/space blanket around the person.
- Wrap the person in a sleeping bag.
- Have an insulation mat underneath to protect against cold ground.
- Have ideally a windproof material such as a bivouac bag, alternatively a second sleeping bag or a blanket around the patient.
- Move the person carefully; this is important as cooler blood from the extremities reaching the body core and the heart can have severe consequences.

Now you can get the person into a warm and dry environment (put up a tent or bring the person to the camp or station). Help them to warm up again by placing warming pads or bottles filled with warm (but not too hot) water under their arms, in between their thighs, and around them. Do not warm extremities by rubbing the skin. Instead, you can help warming up extremities by putting them directly onto your skin at the belly or your armpits. Give the cold person warm (but not too hot) and sweet drinks.

If the symptoms do not disappear, it is vital to seek proper medical help as fast as possible. Do not attempt to re-warm a person who is severely hypothermic (with core temperature below 32 °C/90 °F); this should only be done by fully-trained medical professionals.

Frostbite

Frostbite occurs when body tissue freezes. Similar to hypothermia, there are various degrees of severity, ranging from superficial to partial and full-thickness frostbite. Symptoms of mild frostbite include cold and numbness, with skin turning red then waxy white. Just the skin surface freezes but remains pliable when pressed. As frostbite becomes more serious in extremeties if the deep tissue freezes.

Factors leading to frostbite include previous frostbite injuries, cold temperatures and wind, high altitude, fatigue, poor circulation (e.g. because of constrictive clothing or footwear), and hypothermia.

Frostbite is almost always avoidable. Frostbite prevention measures include:

- Partner up with a buddy and watch each other for tell-tale signs of frostbite such as whitening of the nose, ears, etc.
- Clothing and shoes should fit snugly but not constrict circulation in any way.
- Expose as little skin as possible by, for example, wearing liner gloves, a face mask, ski googles, etc. Ideally you should be able to operate all of your equipment with gloves on.
- If you have to expose skin such as your face, use weather protection lotion. This should have 0 % water content.
- For frostbite prevention, shower in the evening when returning from the field (if showers are possible). This will help to keep your skin's natural fatty protective layer intact during the day and reduces the risk of frost bite.
- Never touch cold metal with bare skin.
- Avoid exercising strenuously as sweat can chill the body very fast.
- Ensure you stay well hydrated and eat adequately.

Treating anything but mild frostbite can be very challenging in the field, so prevention is key. Superficial frostbite can be effectively treated by warming the affected area. Avoid rubbing since this causes additional tissue damage from the ice crystals within. Partial-thickness frostbite should be treated by warming the affected area with water around 40 °C/104 °F and then keeping the area warm and bandaged for protection against infection. Treatment of full-thickness frostbite should not be undertaken if there is any chance the affected area can refreeze. Again, the area should be warmed with water at 40 °C/104 °F and then treated with dressings and bandages since the area will likely swell, blister and become extremely painful. Usually though, it is advised that severe frostbite is left frozen until specialised medical personnel can take care of it.

Less serious than frostbite, but nonetheless worth watching out for, are chilblains (chill burns). These form when capillary beds in the skin become red, itchy, and inflamed as a result of exposure to cold and humidity. This can, for example, make it uncomfortable to wear gloves, which only exacerbates the problem. Chilblains can be a precursor of frostbite, so make sure to keep extremities warm and protected from the wind.

Altitude sickness

While most INTERACT stations are located low high altitudes, you may be doing some fieldwork higher up in surrounding mountains. Altitude sickness can affect anyone, regardless of fitness level, age, or previous experience at altitude. Symptoms start from headaches and nausea and go all the way through to coma and death. They usually start within about 12-24 hours after arriving at altitude, and then diminish during descent and as the body acclimatises.

It is best to take the time to acclimatise (usually ascending not more than 1000 m per day – when you are at altitudes above 2000 m) and not to exert oneself too much for the first few days (if you are going to be spending a few days or weeks at altitude). It is also important to stay well hydrated and avoid tobacco and alcohol. Team members should check on each other; it is important to be honest with how you are feeling. If, after 72 hours, someone is still showing symptoms of altitude sickness, make sure they descend in altitude. This should generally alleviate all symptoms fairly rapidly.

Snow blindness

Snow blindness occurs when the eyes are burned by ultraviolet (UV) light that reflects off the snow surface, most commonly on cloudy days. It can be easily prevented by wearing proper UV-protective sunglasses or goggles. However, should symptoms (intensely painful and red eyes that are light sensitive) occur, treatment includes resting the eyes for at least 24 hours. This means closing them and covering them with a pad and possibly a cool compress if temperatures are above freezing. Episodes of snow blindness can last up to 5 days and can be crippling, seriously delaying a field team. It is a condition that should and can easily be avoided.

Sun- and windburn

Sun- and windburn can easily occur when you are out in the field, particularly in snowy areas or at altitude, whether it is a sunny or a cloudy day. In the short-term, skin damage can be uncomfortable and burns that blister can become infected. Sunscreen should be regularly applied to all exposed areas, including lips, under the nose, and the tips of ears, while covering all exposed skin with clothing can also prevent sun- and windburn. If it does occur, treat the affected area with aloe vera or a similar soothing cream until the skin is fully healed and make sure the area is not exposed again to either the sun or strong wind.

Sprains and strains

Sprains and strains are some of the most common injuries that occur out in the field. A sprain involves tearing ligaments that supports a joint, while a strain is usually less serious and involves overstretching a muscle. Work and travel carefully and thoughtfully to avoid these injuries. Using hiking poles can also prevent such injuries. However, if you suspect a sprain or strain injury the following treatment is recommended:

- Rest – stop any activity and get the patient comfortable, setting up shelter if necessary.
- Ice – if possible cool the affected area with cold water, snow or ice for approximately 15 minutes, avoiding direct skin contact.
- Compression – wrap the affected area with an elastic bandage, ideally also immobilising the joint as best as possible. Be careful not to wrap to tight as this may prevent blood flow.
- Elevation – keep the affected limb or joint raised to reduce swelling.

Burns

A burn can result from contact with a heat source, such as a hot liquid, metal, or steam, as well as from chemicals. There are varying degrees of burns, from minor (just the skin surface) through to severe (the deeper skin tissues). Burn injuries can be easily avoided by being careful when cooking, using chemicals or around any heat sources, such as fires (for example be aware of various synthetic materials that are easily flammable).

Should you or anyone on your team get burned, it is best to:

- Move the person away from the heat/chemical source.
- Cool the burn with running water for up to 20 minutes. If no running water is available, a water bath or applying burn gel is a good alternative.
- Do not use ice, iced water or any greasy substances such as butter (the latter of which can easily cause infections).
- Remove any clothing or restricting items, such as jewellery or belts, since the burned area may become inflamed. Do not remove anything that is stuck to the burned skin.
- Cover the burn with a layer of clean plastic kitchen film or a sterile gauze bandage to ensure it becomes not infected.
- Keep the person warm, for example, by wrapping them in a blanket.
- Give the person a painkiller such as paracetamol or ibuprofen, if necessary.
- If possible, keep the burned area above the heart as this helps to reduce swelling.

Should one of your team members get a more serious deep burn, a medical professional should look after this. You will need to contact the station and possibly might need to organise evacuation of that person.

EU Horizon 2020

INTERACT

International Network for Terrestrial Research and Monitoring in the Arctic

INTERACT is a one-stop shop for access to research infrastructures in the Arctic and adjacent boreal and alpine areas of the Northern Hemisphere. The main objective of INTERACT is to build capacity for identifying, understanding, predicting and responding to changes throughout the wide environmental and enveloped of arctic, northern boreal and alpine areas. The INTERACT network of field stations hosts top level research and monitoring projects and programmes within a wide range of scientific disciplines.

This book is about planning of fieldwork activities in the Arctic and other cold regions of the Northern Hemisphere. It covers all aspects of fieldwork from capturing the idea through the actual fieldwork to getting safely back home with samples and data to wrap up the project. As such it is a resource for scientists, facilitating safe fieldwork and maximizing the results of research and monitoring activities carried out at stations in the INTERACT network.

The book has been developed and written by INTERACT station managers and the Association of Polar Early Career Scientists (APECS), and although it focuses on fieldwork conducted at arctic and northern boreal and alpine field stations, it also contains information relevant to researchers not working out of research stations.

ISBN: 978-87-93129-13-9

Let's INTERACT !

www.eu-interact.org